THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXVII., No. 10. Whole No. 1,682. | NEW YORK, MONDAY, SEPTEMBER 2, 1907. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. THOMAS J. CUNNINGHAM, ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States, $3; Canada, $4 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A.M. Callender & Co.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Second Annual Meeting, American Gas Institute.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Aug. 19, 1907.

To the Members, American Gas Institute: The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18, and will be called to order by the President, Walton Clark, of Philadelphia. The New Willard Hotel has been chosen as headquarters.

The following schedule of rates offered by various hotels in Washington are submitted:

		Without Bath. One Person. Single Room.	Without Bath. One Person. Double Room.	Without Bath. Two Persons. Double Room.	Without Bath. Two Persons. Extra Large Room.	With Bath. One Person. Single Room.	With Bath. One Person. Double Room.	With Bath. Two Persons. Double Room.	With Bath. Two Persons. Extra Large Room.
New Willard	E	$2.50 up.	$3.00 up	....	$4.00 up.	$3.50 up.	$4.00 up.	$5.00 up.	$5.50 up.
Raleigh	E	2.00	3.00	4.00	4.00	3.00	4.00	4.00	6.00
		....	....	....	....	3.50		6.00	up.
Occidental	E	Suites 2 bedrooms, Parlor and bath, $4 and $5							
Shoreham	E	2.00	3.00	4.00	5.00	3.00	4.00	5.00	7.00
	A	4.00	5.00	8.00	9.00	5.00	6.00	9.00	11.00
Arlington	E	2.00	....	4.00	4.00	3.00	....	5.00	5.00
	A	4.00	....	4.00	8.00	5.00	....	9.00	9.00
Normandie	E	1.50	2.00	2.00	2.50	2.00	3.00	4.00	4.00
	A	3.00	3.50	5.00	6.00	3.50	5.00	8.00	8.00
Riggs House	A	3.00	3.50	6.00	7.00	4.00	5.00	8.00	10.00
Grafton	A	3.00	3.50	6.00	....	5.00	6.00	8.00	....
		....	5.00	8.00	....	....	....	9.00	....
Cochran	A	....	....	....	....	....	4.00	7.00	....
Metropolitan	E	1.00	2.00	2.00	3.00	2.00	2.50	4.00	6.00
		....	....	....	....	....	3.00	....	up
	A	2.50	3.00	5.00	6.00	3.50	4.00	7.00	8.00 up
Ebbitt	A	3.00	....	6.00	....	5.00	6.00	10.00	....
		4.00	....	up	....	....	....	....	....
St. James	E	1.00	2.50	3.00	....	2.50	3.00	4.00	....
		2.00	4.00	4.00	....	3.00	4.00	6.00	....
National	E	1.00	2.00	2.50	3.00	2.00	....	4.00	....
		....	....	....	....	2.50	....	....	....
		2.50	3.00	5.00	6.00	3.50	....	7.00	....
		....	....	....	....	4.00	....	....	....
Howard House	E	2.00	....	2.00	6.00	....	....	....	....
		2.00	....	2.50	....	....	....	....	....

E—European Plan. A—American Plan.

The named papers have been secured by the President for presentation to the Institute, together with the reports of the following committees:

"Depreciation;" by Mr. A. C. Humphreys.

Communication from New England Association; by Its Committee on Uniform Accounting and Depreciation.

Report of Committee on Methods of Taking Candle Power; by Mr. Wm. H. Gartley, Chairman, Philadelphia, Pa.

Experience in Omaha on "Delivering Uniform Candle Power to Consumers;" by Mr. George H. Waring.

LIBRARY OF CONGRESS AUG 3 1907 SMITHSONIAN DEPOSIT.

"The Obligations Imposed by the Possession of a Franchise;" by Mr. Chas. H. Dickey.

Report of Public Policy Committee; Mr. E. G. Cowdery, Chairman.

Report of Committee on Making of Rates and Additional System of Costs; Mr. W. H. Gardiner, Chairman.

Report of Committee on Economic Balance between Calorific Value and Candle Power; Mr. Thos. D. Miller, Chairman.

Report of Committee on Board of Revision; Mr. J. D. Shattuck, Chairman.

"Instructions for Operating Recuperative Benches;" by Mr. W. A. Baehr.

"Experiments in Carbonization;" by Mr. W. H. Fulweiler.

Lecture on "Electrolysis;" by Prof. A. F. Ganz.

Report of Committee on Electrolysis; Mr. A. G. Glasgow, Chairman.

Report of Committee on Pipe Standards; Mr. Walton Forstall, Chairman.

Experience with Dipping Meters; reports from Baltimore, by Mr. A. S. Miller. Also reports from Philadelphia and Savannah.

Report on "A" Meter Results from Philadelphia and Kansas City.

Report of Committee on Uniformity of Meters; Mr. Charles H. Dickey, Chairman.

"Air Blast Gas Appliances," by Messrs. W. K. Eavenson, Philip Cross, W. J. Clark and W. H. Allen.

The Passenger Associations will not consider rates on the certificate plan until after their next meeting, which convenes September 10th. Many State Legislatures having enacted the 2-cent rate, the Commissioner of the Trunk Line Association writes as follows:

143 LIBERTY ST., N. Y., July 25th, 1907.

MR. JAS. W. DUNBAR, Sec. American Gas Institute, New Albany, Ind.:

Dear Sir—Referring to your letter of the 15th, beg to advise that, on account of the unsettled rate conditions, the Trunk Lines feel they cannot consider the question of reduced fares for meetings or conventions to be held after the month of September, until their next meeting, which will convene on September 10th, after which we will promptly communicate to you decision reached respecting your application. Yours truly,

(Signed) L. P. BARNES, Commissioner.

The Secretary will be pleased to mail applications to those who may wish to become members of the Institute. Further detailed information in reference to the convention will be forthcoming.

Yours truly, JAMES W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

Change of Meeting Place, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF SECRETARY,
DETROIT, MICH., July 1, 1907.

To the Members, Michigan Gas Association: Owing to unavoidable delays in the completion of the new hotel at Kalamazoo, Mich., the Executive Committee has changed the place of meeting from Kalamazoo to Battle Creek, the meeting to be held September 18, 19 and 20, 1907. A notice will be sent in the near future giving full information in regard to hotels and programme, for papers as well as entertainment. Respectfully, ALONZO P. EWING, Secretary.

[NOTICE.]

Wrinkle Department, the American Gas Institute.

To the Membership, American Gas Institute: All members of the American Gas Institute, and others interested, are requested to contribute a description of any novel device or scheme covering any feature of the gas business. Every department of every company uses some novel stunt which would be of value to others. The object of this department is to compile such information. The value of the report depends entirely on the co-operation received. Send in your contribution at once to MILAN R. BUMP, Editor,
60 Wall street, New York.

[NOTICE.]

Fifteenth Meeting, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
SAN FRANCISCO, CAL., Aug. 17, 1907.

To the Members of the Pacific Coast Gas Association: As the date[1] of our fifteenth convention is drawing near, I take this means of notifying you of the following arrangements that have been made, in order that you can make your plans accordingly:

Railroad Rates.—The Southern Pacific Railroad Company has named a special rate of full fare and a third, from all points in California to Santa Cruz and return. Instructions have been issued to their Agents to put this rate into effect 10 days prior to the meeting, and the same will remain in force 48 hours after adjournment of the convention on Thursday, September 19th; in other words, up to the Saturday night following the close of the meeting. At the time of purchasing your tickets you should notify the Agent that you are to attend the Association meeting, and at that time you will be furnished with a receipt certificate, which certificate will have to be countersigned by the Secretary of the Association or his representative in in order to secure your return ticket from Santa Cruz. You should buy your ticket for one way only, and for which you will be required to pay full rate, but your return ticket, after the receipt certificate has been countersigned by the Secretary of the Association, will be furnished you at one-third of the regular fare. The above arrangement will also apply to tickets purchased at Reno, Nev., by members of the Association as outlined.

Papers.—While I am not prepared at the present writing to advise you of the titles of the various papers to be presented before the convention, still they will be up to the usual standard and no doubt bring forth discussions of much merit; suffice it to say that all who attend the coming convention will return to their "camping ground, wiser and better men," for all those who visit beautiful Santa Cruz never have an idle moment, and if they do 'tis their own fault.

I am inclosing you herewith postal card, which you will kindly fill out and return at the earliest possible moment, in order that accommodations can be reserved at once, as simultaneously with the convention there will be a big automobile meet, and this, with all the other attractions, will tend to draw a greater crowd than usual.

Make your arrangements at once, and give your wife, children and sweethearts something to look forward to by getting in line for the banner meeting of the Association. Don't fail to advise me promptly of your intentions. Yours very truly, JOHN A. BRITTON, Sec'y.

1. The Convention will be called to order Tuesday, the 17th.

BRIEFLY TOLD.

OBITUARY NOTE, MR. AUGUSTINE MALLORY.—We regret very much to have to chronicle the death of Mr. Augustine Sheppard Mallory, who passed away the morning of August 9th, and whose funeral was held in the home of his father-in-law, Dr. F. P. Wunder, 6108 Baynton street, Germantown district of Philadelphia, the afternoon of August 13th. Deceased, who was in every best sense of the term a self-made man, was born in Charlotte, N. C., April 22, 1871, which place had hardly then even commenced to feel relief from the stress of civil war. At an early age he took service with the Messrs. Leddell & Co., of Charlotte, and in 1891 he removed to Philadelphia, and shortly thereafter entered the service of Messrs. R. D. Wood & Co., acting in the capacity of field engineer. Later on he became attached to the engineering division of the Mutual Gas Light Company, of the city of New York. In due time opportunity served to attach himself to the engineering staff of Bartlett, Hayward & Co., of Baltimore, and his suitability was such that at the time of his death he was superintendent of construction and resident engineer of that corporation. In 1896 he was united in marriage to Miss Gertrude A. Wunder, of Germantown, who survives him, as does his father, Mr. Wm. A. Mallory. Deceased was widely and favorably known in the gas works construction circles of the country, and it is to be very much regretted that death claimed him at a time when his fame as a constructor was rapidly spreading.

CURRENT COMMENT.—

THE Norfolk City (Va.) Gas Company has awarded an important contract, for extending its condensing and purifying syitem, to Mr. Frank D. Moses. The works at Hampton, Va., which were completed by Mr. Moses some time ago, are running along with the greatest possible smoothness, and the owners of the system are satisfied that Hampton needed a gas supply, for well on to 700 consumers' names are on the Company's lists.

THE new holder for the Elkhart (Ind.) Gas Company will be completed by December 1st. It is of the 2-lift order, and the lifts are 33 feet each. It is to rest in a steel tank, virtually all above ground.

A RECENT issue ot the Chattanooga (Tenn.) *News* says that the boulevard stretch, or on East Ninth street, between Market street and Georgia avenue, is the best lighted street in the city, between sundown and sunrise. Lamps of the Boulevard pattern, fitted with Welsbach mantles, are the vehicles employed.

WRITE to the Suburban Gas Company, of Philadelphia, for a copy of its publication for the current month entitled "Gas-ps." It is all to the good.

Talks on Movable Pipe Joints.

Communicated by "ENGINEER."

All gas men and gas pipe fitters have noticed the increased requirements for gas piping systems having movable connections between the drips, pipe series, outlets, inlets and various connections to meter, main or other service. These turns are effected in several different ways, some of the important of which are illustrated in the attached diagrams. Possibly one of the most imperfect descriptions of lead in which there is a turning point made in the joint is the common thread turn shown in Fig. 1. In this defective style of turn the revolving of the movable pipe on the fixed end is accomplished entirely by turning the threads of the one on the other. The main (*A*) is fixed, for example. There may be an occasion on which the connection pipe will have to be turned a full, half or quarter turn. It is an easy matter to apply the proper tools and turn the joint on the threads *B* to the desired point; but if in turning the same you have turned the joint outward, as often happens, the threads will become loosened and leaks may be generated. If you turn in you may and you may not tighten the threads. Therefore, in the more practicable systems of joints in which it becomes essential to effect a turn to one end or the other of pipe at stated intervals, the collar system is often used, as illustrated in Fig. 2. The collars are on the main as at *c*, *c*, and are cast thereupon. They should be turned to make true, unless it is intended that the collars be packed with rubber or kindred gaskets.

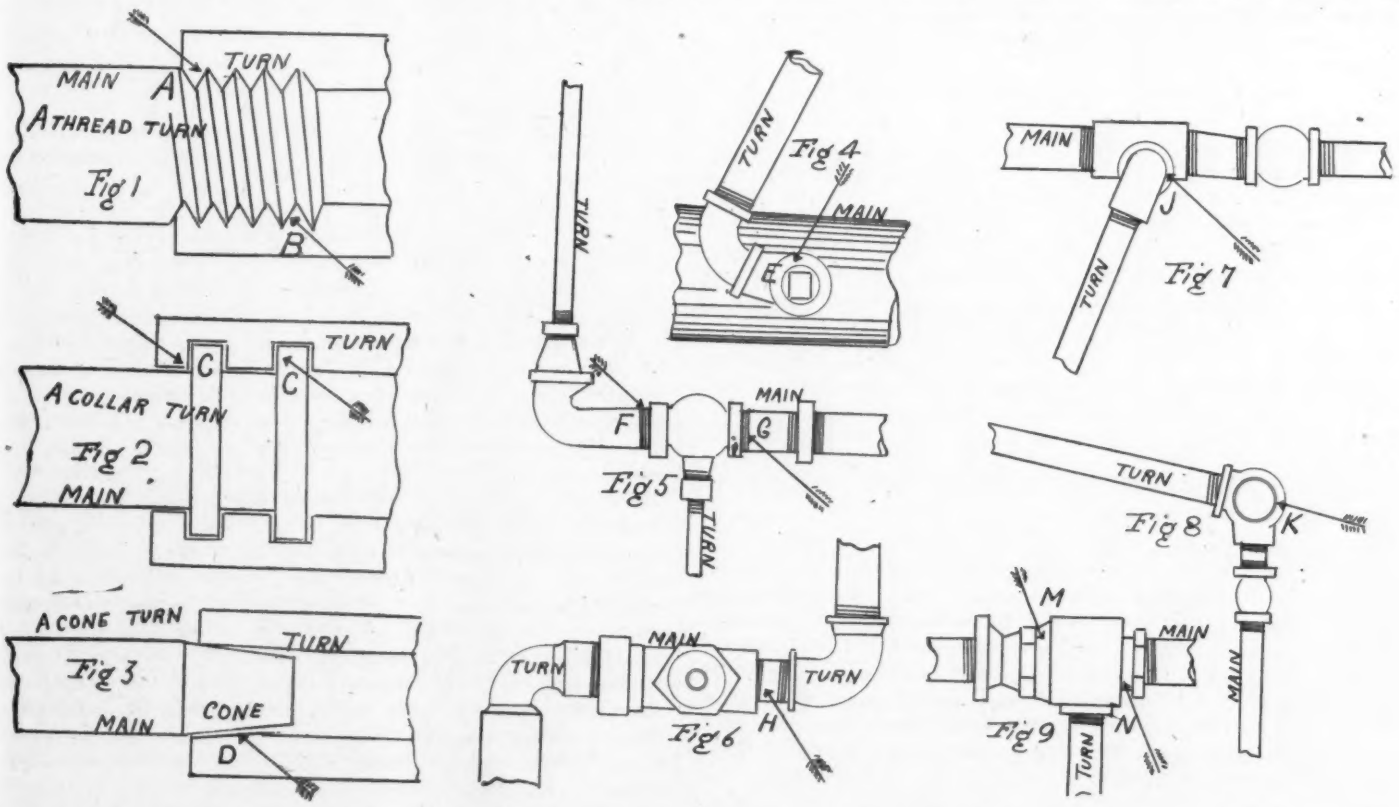
The joint fitting on the collared end is properly grooved to fit over the collars, and the adjustment is made by having the union made in two pieces, flanged and bolted, hence the sides can be placed over the end on the collars or rings and tightened up just enough to permit turning of the joint whenever it is necessary. With proper bushings a revolving connection of this kind can be made secure against leakage.

The bevelled-end union, or the cone turn, is shown in Fig. 3. This joint depends upon its tightness by the coned end of the pipe being driven into the open end of the adjoining pipe. It is not a very proficient method, but answers the purpose in cases in which the joint is not liable to be strained very much. The contacting surfaces of the cone and interior of the union at *D* must be true. The cone end should be turned down or filed perfectly smooth.

Sometimes it is necessary to get a connection with a movable pipe on a main, as illustrated in Fig. 4. Here the main is bored in the usual manner and a coupling inserted. If possible, the coupling is flanged on the inside. A joint is made, threaded and provided with the capped piece as shown. Instead of having the set piece connected permanently with the elbow, there an additional union is fixed on, and this additional union, while jointed with the plug in the main, is free for turning in the bushed cap of the connection at (E). Hence it is possible to turn the projecting pipe in any direction, to the right, left, up and down. A complete circle can be made. The tightening or loosening of the cap-bolt controls the joint. A very poor turn results when one does as shown in Fig. 5.

In this combination reliance is placed entirely upon the thread joints for revolving. There are no flanges or gaskets and the pipe jointing is made in the usual manner. Then occasion arises to turn the leader pipe up or down. This is done by turning the leader joints on the threads, when one side will tighten on the threads and the other will open. As the chances are that the open side will leak this sort of movable pipe system is not used to any great extent. *F* and *G* designate the points where the threads would open or close, as the case might be, in the turning over of the drip.

Then I find turns made with the valve combination, as shown in Fig. 6, in which the turning is done on the few threads of the jointing piece *H*. This mode is as imperfect as the one just referred to; still, both these methods may be found in service in places where it becomes necessary to unexpectedly turn up or down on the connections. The result is that leaks are developed, some of which are serious ones.



To swing a pipe over to one side or the other, on the point of connection, *J*, Fig. 7, is very likely to create a leak at the threads unless the turn is made in the tightening direction, in which case no trouble may issue; but I notice that, in making many of these turns, the pipe union is caused to open, the thread spaces become widened, the adhering cements become broken and leaking is caused.

Another form is shown in Fig. 8, in which a flanged combination is made at *K*. This description of union is favorable when it is necessary to get an angle of varying form; that is, when the angle is altered to meet with certain requirements. Perhaps it is necessary to maintain the pipe upright when not in use. When needed, it can be turned down. The flanged joint with its movable bushings makes it possible to get the joint tight and at the same time permits the dropping or elevating of the pipe. The letter *K* designates the point of the turn.

In Fig. 9 is still another form of union for effecting the same end, in cases in which drop sections of the pipe are needed for certain purposes. The central bushing is adjusted with flanges and sleeves at *N* and *M*. By tightening up on, or by loosening the adjusting nuts on either side, you can get the connection fairly well registered so as to permit the free turning of the union without danger of its leaking

Fuels for Motor Purposes.

Engineering, London, says: In this country we seem to be forever on the eve of some great catastrophe. Either it is the Army has fallen to pieces, or else some one suddenly discovers that the combined fleets of China and Chile have more submarines than we have, or something equally momentous and disastrous is about to happen in the industrial world. The last few days has seen a double proclamation of such a prophecy, foreseeing trouble ahead of us. On the one hand, the Motor Union has issued a report, proving conclusively that the world's supply of petrol is rapidly nearing its end, and advising the encouragement of the use of alcohol as a fuel, as the only means of salvation to the still young and very vigorous motor industry. On the other hand, the chairman of one of the two leading oil trading companies deplores the fact that "the one territory capable of providing supplies of liquid fuel sufficient to meet the naval requirements of this country has passed from British hands," and at the same time he gives it as his opinion that the one reed on which the Motor Union leans is but a slender one; for have not the alcohol-using motor cabs of Berlin taken to using petrol fuel? One grain of satisfaction may we get, however, from Sir Marcus Samuel's speech at the recent half-yearly meeting of the Shell Transport and Trading Company. He is satisfied, in spite of the report of the Fuels Committee of the Motor Union, that the supply of petrol will be ample for the future.

Confronted at once by all these statements, it is a little difficult to calmly weigh up the situation. In spite of our sympathy with Sir Marcus Samuel on the question of liquid fuel for the Navy, we will not discuss that matter at this time. With regard to the supply of petrol, however, the remarks of the Chairman of the Shell Company are particularly interesting at this moment, following, as they do, immediately on the publication of the above-mentioned report.

This report divides itself into two parts. The first is, perhaps, somewhat alarmist, while the second portion allays some of the disquietude created by the first. The use of such expressions as "alarming," "threatened famine, "serious rise of prices," etc., with regard to the petrol trade, would seem to suggest that all users of motor vehicles had better at once cast about for some fuel less likely to fail, after a few years, than petrol. The American fields are, it appears from the report, rapidly becoming exhausted, and what petrol still comes from them is used almost wholly within the countries of that continent. Petrol is, in fact, we are told, within measurable distance of ceasing to exist. We are apparently given but two more generations, and those that follow after that lapse of time must talk of other things than petrol motors.

Petrol spirit is not yielded by all crude petroleum oils, and the Russian oils supply practically no petrol suitable for use on cars. The total yield of petrol on the world's output of petroleum is stated to be only about 5 per cent., so that a large amount of crude oil must be produced in order to obtain an appreciable amount of spirit. The committee estimate that at the present rate of increase of the motor industry, in another 3 years the demand for petrol will have risen in this country alone to 360,000 tons per annum, compared with 150,000 tons at the present time, while the world's supply of crude petroleum has for years remained practically stationary, new discoveries not augmenting the supply, but merely supplementing the reduced output from older fields.

But against this somewhat dismal picture we are assured by Sir Marcus Samuel that the Shell Company have proved, in Koetei alone, territory over 60 miles in length, the whole of which area promises to yield sufficient crude oil to enable the world's supply of petrol to be maintained. If this is so, of course, the Shell Company is in a very fortunate position, while the motor world will be given a few more years in which to make the change from petrol to some other fuel.

As petrol is a distillate of petroleum, its price must largely depend, as Sir M. Samuel pointed out, on whether crude petroleum is to be produced for the manufacture of petrol alone, or whether a satisfactory market can be found for the other products of the process. At present such is the case, and increased use of paraffine, etc., will tend to keep the price of petrol from advancing. Sir Marcus states that "there is room for a very large and rapid increase of the petrol trade before any alterations could take place in these conditions. In fact, supplies of petrol are to-day so ample that in order to endeavor to encourage consumption, as also to meet competition, we have voluntarily reduced our prices to some extent; and, so far as I can see, there is not the remotest danger of any failure to petrol supplies, even if our most sanguine hopes as to the increase of the motor industry should be amply fulfilled." As the price of petrol has been recently 60 per cent. higher than it was in 1904, it is evident that a fall in price will be most welcome. The report, however, states that "notwithstanding increased facilities, the price of fuel (petrol) continues to rise rather than fall."

In suggesting a remedy for this state of affairs, the committee have placed possible fuels in two classes. One class contains those fuels limited in amount, and the other class those of unlimited amount. Comparatively speaking, all petrol, paraffine, benzol, coal or producer gas fuels are limited. Even the oil field known to Sir Marcus Samuel will become exhausted in time, and all light or heavy fuels derived from crude petroleum are at a disadvantage for this reason. It is with them a question of time, much as it is with the exhaustion of our coal fields, and whether or not the Motor Union is too pessimistic, and the Chairman of the Shell Company too optimistic, are merely matters that it will take time to prove. Such substitutes as paraffine, therefore, apart from the difficulties due to lack of range of possible speeds, are not viewed with any great assurance by the Motor Union. Coal dust as a fuel has so far thwarted all attempts to work it economically, owing to difficulties of regulating the proportions, the trouble with residuals, and the slowness of combustion. Producer gas is left, so to speak, open, the Fuels Committee considering that the future may possibly bring forth some suitable producer working with specially prepared fuel. Benzol is regarded with a certain amount of favor, and it is stated that there are firms here who are willing, if the demand justifies it, to put down benzol recovery plants in connection with coke ovens, etc.

With alcohol, however, as an unlimited source of supply for the future, or with some mixture of alcohol and benzol, the Committee apparently think the future lies. In using such a fuel this country would be independent of others - a matter of some importance when fuel for submarines or motor transport in time of war has to be considered. Should existing restrictions be so relaxed as to allow the economical manufacture in England of denatured alcohol, the Fuels Committee, in common with the recent Department Committee on Industrial Alcohol, considers that the use of this fuel would be attended by no insuperable difficulties. In fact, in view of its safety, flexibility, limit of compression, etc., in which points it is far ahead of the petrol at present in use, the report suggests a brilliant future for alcohol, provided legislation does not continue to throttle it, as is done at present.

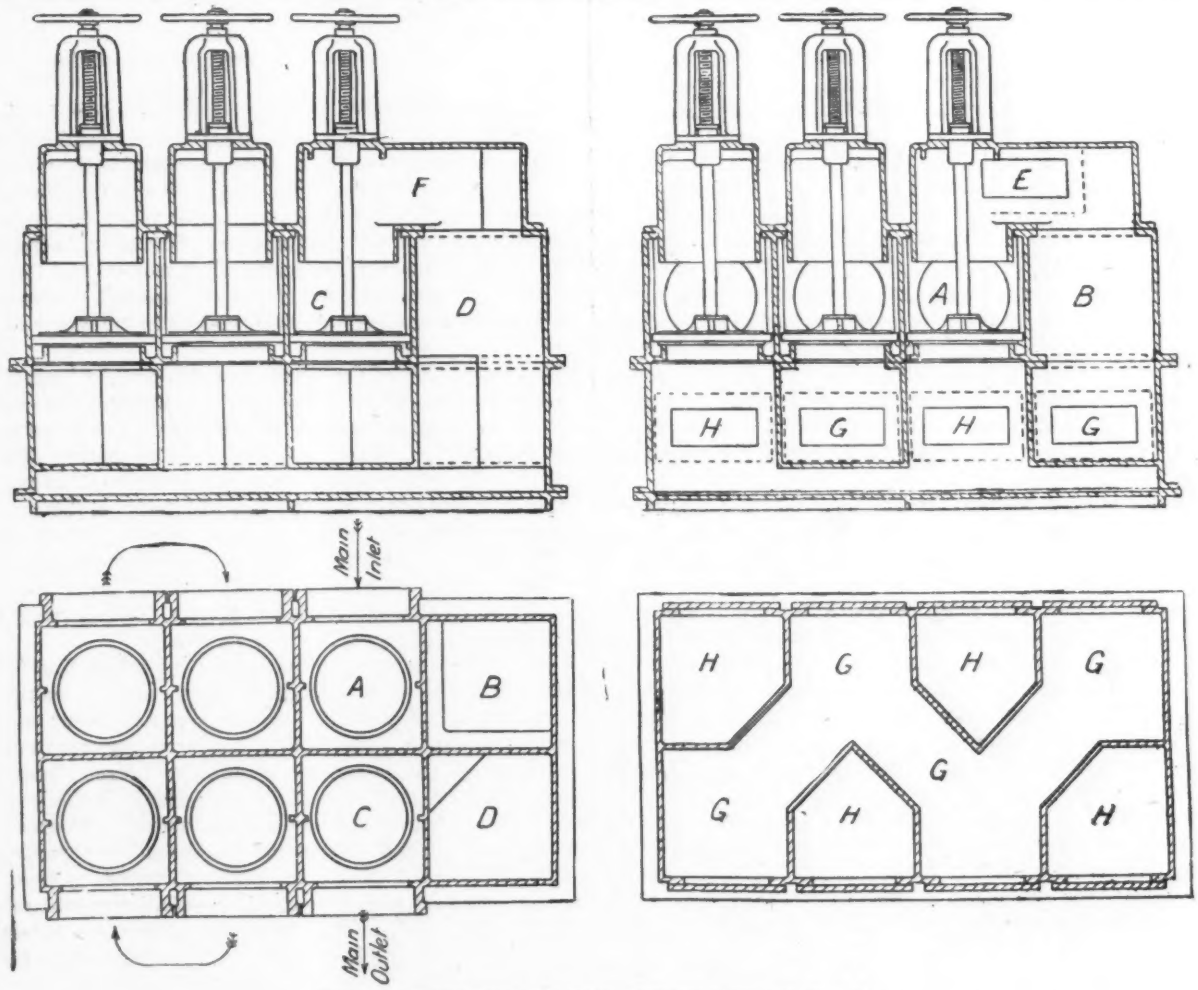
If the report of the Fuels Committee does no more than add weight to the movement to press the Government on this subject of the manufacture of denatured alcohol, it will have materially assisted the engineering trade, and perhaps have helped to found a new home industry. Until the heavy excise duties are removed even experiments with alcohol motors are almost out of the question, and these, as all others, must of necessity pass through their experimental stages. If, then, experiment be rendered possible, the really successful alcohol motor may be ready to take the place of the petrol motor, when, if not before, that time foreseen by the Motor Union arrives, when our grandchildren or great-grandchildren can buy neither Pratt's nor Shell, nor any other brand of petrol spirit.

Reversing the Flow of Gases Through Condensers and Purifiers.

The accompanying illustrations show a reversible valve on Weck's system, recently provisionally patented by Messrs. Robert Dempster & Sons, Limited, Elland. The valve shown is arranged for working two condensers or two purifiers either in the usual way or in the reverse way. Besides reversing the flow of the gas, the valve can be worked in the same manner as an ordinary center valve, that is, either one box or two boxes can be worked, and in addition to that both boxes can be by-passed entirely by means of the valve. The valve can also be made for 3, 4 or even more boxes, and can be made in sections, if found more convenient, and bolted direct to either condensers or purifiers.

The difference between this valve and the ordinary type of valve consists in adding two more compartments to an ordinary valve and fixing the main inlet and outlet sockets on the same level as the connections to the boxes to be worked, instead of below, as is usual. Connection is then made between the main inlet socket, *A*, and one of the extra compartments, *B*, and between the main outlet socket, *C*, and the other extra compartment, *D*, by the usual hoods, *E* and *F*,

1. *Gas World.*



Dempster's Patent Reversible Valve—Sectional Plans and Elevations.

over the top of the valve, and the extra compartment, *B*, communicating with the main inlet socket, *A*, through the hoods or connections, *E*, also communicates with the main outlet chamber, *G*, in the bottom part of the valve, whilst the extra chamber, *D*, communicating with the main outlet socket, *C*, through the top hood, *F*, of the valve also communicates with the main inlet portion of the valve, *H*, below. Thus to by-pass the valve altogether, either the main inlet or the main outlet valve is raised to the top seat and the remainder shut down, when the gas will travel straight through from main inlet to main outlet socket without entering either condensers or purifiers. To work boxes Nos. 1 and 2 in the usual way through the inlets, the main inlet and main outlet valves should be raised to the top seat, and also the inlet valve to No. 1 box and the outlet valve from No. 2 box, in which case the gas will flow through No. 1 box and then through No. 2 box and away, or to work No. 1 box only the main inlet and outlet valves and the inlet and outlet valves to No. 1 box should be opened to the top and the remainder of the valves shut down. No. 2 box would, of course, be worked in a similar manner, by opening the valves belonging to that box instead of those belonging to No. 1 box.

To reverse the flow of the gas and to work No. 1 and 2 through the outlets instead of through the inlets, the main inlet and outlet valves should be shut down on the bottom seats, the main outlet to No. 1 and the main inlet to No. 2 box shut up on to the top seat, and all other valves shut down. The gas would then pass straight from the main inlet socket into the main outlet chamber and enter No. 1 box through the outlet, come back to the valve through the inlet, go to No. 2 box through the outlet, come back to valve through the inlet, where it would drop into the main inlet chamber and away by the hood *F*, through the main outlet socket *C*.

The valve itself is a very simple one and of a design now generally understood throughout the country, both of which points should recommend it to the notice of gas engineers.

THE contract for the benchwork of the Tri-City Gas Company, of Gadsden, Ala., has been awarded to the Laclede-Christy Clay Products Company, of St. Louis.

Long Distance Transmission by Means of Direct Current.

The *Elec. World* says that in the United States everyone thinks of 3-phase alternators and step-up transformers when it is proposed to transmit energy over many miles electrically, but in Europe, as we have frequently noticed in these columns, there is a direct current system that has been in use for this purpose almost 20 years, namely, the Thury constant current system, which is in competition with the standard polyphase equipments for all European long distance transmissions, and has many advocates among electrical engineers.

The longest and highest voltage Thury current system is the one at Lyons, France, but this has not been operating a sufficient length of time to enable reliable conclusions to be obtained from it. Its immediate predecessor, the Lausanne system, has, however, now been in continuous operation for about 6 years, and although much shorter and of lower tension, one is able to draw deductions from its service. The energy is obtained from the rapids of the River Rhone, near the little Swiss village of St. Maurice, and is transmitted electrically to Lausanne on Lake Geneva, a distance of 56 kilometers (35 miles) at a substantially constant direct current strength of 150 amperes and a voltage which varies with the load up to a maximum of about 22,000 volts with 2,000 volts drop in the transmission. A detailed description of both the above systems appeared in onr pages shortly after operations began.

In broad outline, the Thury direct current transmission system resembles the ordinary constant direct current arc light system, except that instead of lamps, motors are operated in series, and instead of a constant current of 8 or 10 amperes flowing under a pressure of a few kilovolts, there is a constant current of 150 amperes under a pressure of many kilovolts. To supply this pressure, a variable number of 2,200-volt generators are connected in series at the generating station, and a similar number of 2,000-volt motors are connected in series at the receiving station.

The current is carried on a pair of copper cables supported on a pole line like any other 2-wire pair of conductors. Except that the porcelain insulators are about twice the size of the ordinary telegraph insulator and the cables are about 300,000 circular mils in cross-section,

there would be little to distinguish the transmission line from an ordinary telegraph or telephone pole line across country. Of course, if the voltages were 60 or 80 kilovolts instead of 20, the appearance of the pole line would probably be distinctive. At the generating station, each of the turbines drives two direct current dynamos on its horizontal shaft, through insulating couplings. Each dynamo is series wound for 2,200 volts and 150 amperes at the rated load of 330 kilowatts. The brushes are all definitely fixed in position, and the voltage of each machine is regulated entirely by varying its speed through the control of the turbine connected thereto. In order to distribute the load evenly among the generators, all of the turbines are connected mechanically to one and the same electro-mechanical governor, so that all the turbines tend to rise or fall in speed simultaneously, unless prevented from doing so individually by independent manipulation. Otherwise, a greater share of the load would tend to fall on those generators whose turbines opened their gates wider and assumed a higher speed. Moreover, unless simultaneously controlled, there might be an oscillatory shifting of the speed and load from one turbine to another.

The first salient contrast between the direct and alternating-current transmission generator plant is in the speed of the various units. With alternators, the speeds of all are the same, and the machines are tied together in synchronism. With direct-current generators, the speeds are all variable, and must be controlled simultaneously. With the alternators, the current-strength and phase determine the load. With the direct-current machines, the speed and voltage determine the load. When the load comes on at Lausanne, the tendency is to diminish the line current. This affects the relay mechanism in the main circuit at the generating station at St. Maurice, and automatically opens the gates of all the turbines so as to increase their speed.

The speed of all the generators thus increases until the correspondingly increasing total voltage restores the line current to the normal strength of 150 amperes. If the speeds and voltages required exceed the normal, the attendant at the switchboard introduces another pair of direct-current dynamos—that is, another turbine unit—into the circuit.

Each generator is carefully insulated from its neighbor by rubber padded couplings, and from the ground by a flooring of asphalt, above which each machine is supported on porcelain insulators. If these precautions were not taken, it is clear that the full voltage of the system might be thrown on the insulation of one armature winding or commutator. By taking these precautions, the individual commutators are not subjected to serious excess of voltage beyond that generated within each armature winding. This constitutes a second salient difference between the direct-current and the alternating-current, long-distance transmission generator system. In the former, the generators must be carefully insulated from each other and from ground. In the latter, the insulation is confined to the step-up transformers, and the generator frames are ordinarily grounded.

At the receiving station in Lausanne, each motor is directly connected through an insulating coupling to a generator of some kind for supplying the distributing system, and all the motors are series wound, and in simple series with the line. The generators are ordinary 3-phase alternators for the lighting and power distribution, and 600-volt direct current railway generators for the city traction. All of these generators are constant speed and constant potential machines, so that all of the motors run at substantially constant speed between no load and rated load. For this purpose, the counter e. m. f. of each motor is regulated by varying the position of the brushes. As the load on each motor increases, thereby tending to lower its speed, the speed governor regulates to restore constant speed, by moving the brushes on the commutator towards a diameter of greater counter e. m. f. Each motor operates constantly with a current of 150 amperes and varies its counter e. m. f. with the load up to a maximum terminal e. m. f. of 2,000 volts at rated load. Here again occurs a marked difference between the direct current and the alternating current receiving station, which is in regard to speed regulation. In the latter, the motors operate at constant speed and require no auxiliary mechanism to maintain synchronism. In the former, the motors require governing mechanism in order to maintain constant speed.

A principal source of trouble with the direct current transmission system considered is from lightning on the overhead lines. This is, however, a source of trouble with almost all transmission lines in Switzerland, and there seems to be no reason for supposing that the trouble is increased in the case of a direct current system. On alternating current systems transformers are frequently burned out when suffering injury from lightning, while on direct current systems the armatures burn out. In each case, line insulators are likely to be destroyed.

The strong points of the direct current system for long distance transmission are that, leaving surges out of consideration, the maximum e. m. f. that the system must withstand is the working voltage, as indicated by the line voltmeters; whereas in alternating current systems, the voltage rises in each alternation to 40 per cent. more than that shown by the voltmeters. Moreover, the pressure regulation is better because there is no inductive drop and the power factor is always 100 per cent. All of these advantages relate particularly to the line and have less weight in relation to the power houses and the machinery therein.

The weak points of the direct current system for long distance transmission are that the commutation limits the size of the generators and motors to comparatively small units, which are relatively expensive and troublesome. Also the system is not adapted for distribution, but only for the transmission of energy in bulk. Alternating current systems always admit of being tapped locally, at the mere cost of installing a stationary step-down transformer; but the direct current system requires a motor generator and men to watch it. The efficiency of the direct current system is thus naturally lower than that of the corresponding alternating current system, even allowing for the losses in the transformers peculiar to the latter.

Summing up, it would seem that as the art of line insulation advances, whereby a good factor of safety can be maintained on the transmission line without excessive cost, the direct current system cannot compete with the alternating current system for long distance transmissions. If, however, the voltages of transmission should press closely upon the means of subsistence—that is, if the insulation along the line could not be commercially maintained with an adequate margin of safety—then the direct current system is capable of becoming a dangerous rival of the alternating current system. It looks at present, however, as though the line insulation problem could be satisfactorily dealt with in the future, and thus the alternating current system is not likely to lose prestige as the best means of transmitting electrical energy.

Coke Oven Gas Power in Germany.

Mr. P. Eyermann recently contributed to the *Iron Age* the following description of a central electric station in Germany, having 4,500-horse power:

The Eschweller Bergwerks Verein, one of the large producers of coal and coke in the Rhine Provinces, installed recently at its mine Anna II. an electric central station, which has demonstrated that coke oven gas can be used with great advantage for operating gas engines. The engines were built by the famous Nurnberger Maschinenfabrik. Fig. 1 shows a ground plan to scale of the entire plant, and Fig. 2 is a view in the engine house. On the ground plan 1 and 2 are engines of 500-horse power each making 125 revolutions per minute, while 3, 4 and 5 are engines of 1,200-horse power each, with 100 revolutions. They are direct connected to alternators, and the three larger ones have especially heavy flywheels. The air, gas and exhaust are provided for by very large reservoirs and pipes, which are dotted to scale in the plan view also. The engines are arranged with all alternators on one center line. The building, which has ample height, is 89 by 203 feet.

Concerning the coke oven gas, I have received from the above Company the following interesting facts: The heating value averages 3,000 calories, or approximately 400 B. T. U. per cubic foot. Gas of this kind, according to various analyses, runs from 300 to 600 B. T. U. Each oven has a capacity of 15,800 pounds of soft coal, and the coking process requires 30 hours. In this period there is given off from one oven about 800 c. cm., or approximately 28,240 cubic feet of surplus gas. Thus each hour there are available 27 c. cm., or about 942 cubic feet of gas. Working under ordinary loads the engines take about 21 cubic feet of coke oven gas per horse power hour, and 45-horse power is thus approximately the result obtained per hour per oven. The plant at which these engines are running secures from 100 to 105 coke ovens about 4,500-horse power. Each oven turns out from the above mentioned 15,800 pounds, charge approximately 5½ metric tons or 12,100 pounds of coke in 30 hours, or about 404 pounds of coke per hour per oven. The chemical composition of the average coke oven gas is as follows:

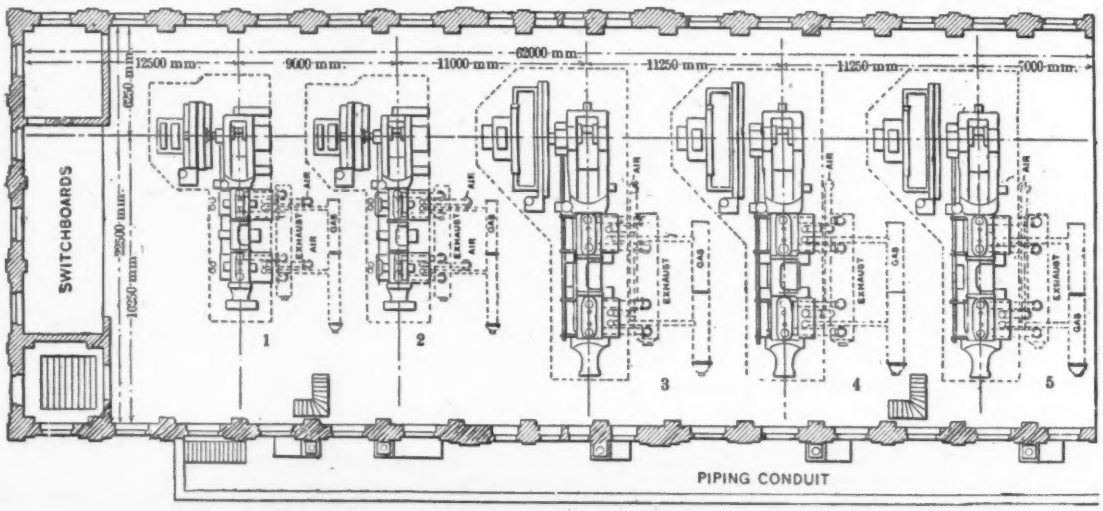


Fig. 1.—Plan of the Central Electric Station of the Eschweiler Bergwerks Verein.

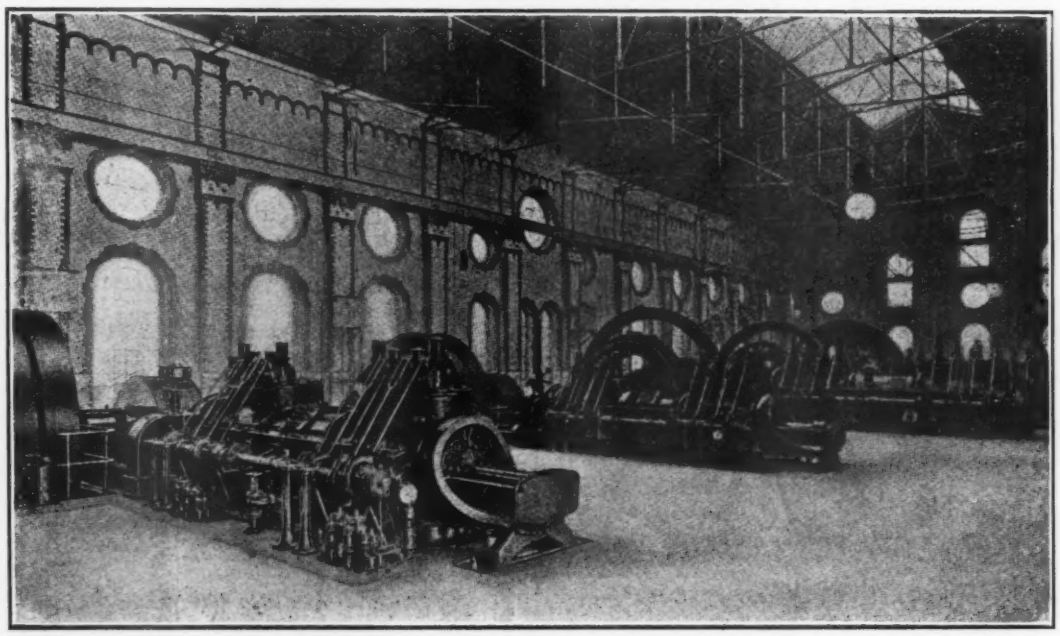


Fig. 2.—Interior of Power House, Showing Nurnberg Engines which are Driven by Coke Oven Gas.

	Per Cent.
H	55.0
CH_4	32.0
C_2H_4	1.5
CO	7.0
CO_2	1.5
H_2O	1.0
CnHm	0.5
N	1.5
Total	100.0

The usual estimate of the amount of coke oven gas given off per ton of coke produced is from 8,000 to 9,000 cubic feet. The results at the Eschweller power station, as given above, demonstrate, therefore, that an up to date coke oven plant with a practical system of by-product recovery gives off sufficient gas to permit of the use of 60 per cent. for power purposes; in other words, the conversion of that much gas into money.

Rigid and Other Joints.

By "H. W.," in *Gas World*.

The very interesting and able article on the "Rigid" joint by "K. P." in the *Gas World* of May 18th, will be cordially welcomed by all who have to do with the distribution of gas throughout the country. Many will no doubt be found to question some of the statements, but at any rate the article is calculated to direct attention once again to the most important question of the jointing of main pipes. It has long been felt to be somewhat of a reproach to the profession that, whilst numerous improvements and adaptations of modern scientific knowledge have been introduced into almost every other branch and detail of gas works practice, in this matter of jointing we are to-day practically where our grandfathers were 60 years ago. Of course, from one point of view, this may be taken as an admirable testimonial to the usefulness, economy, and all-round adaptability of the open lead joint as generally used. But the dimensions of the unaccounted-for gas account of undertakings, even where this has been reduced to far below that of the exceptional case mentioned by "K. P.," should be sufficient to disturb the equanimity and arouse from indifference anyone who has given the matter even an hour's serious attention. Any contribution, therefore, having for its aim the considerable diminution of leakage in our distributory systems is always assured of earnest and serious consideration.

The "Rigid" joint, as described by "K. P.," appears to be an extension to steel mains of the principle of the familiar improved turned and bored joint used with cast iron mains, with the modifications necessitated by the difference in the materials of which the pipes are composed. The tapered surfaces of the sections of the spigot and socket, which are in contact in the turned and bored joint, however, give place in the "Rigid" joint to an approximately tight fitting telescopic joint, and in the latter the bearing surfaces are considerably lengthened. It is claimed that this form of joint, by transferring vibration and strain from the joint to the main body of the pipe, tends to protect the former from the stresses to which it is subjected under ordinary conditions. Within certain limits this is undoubtedly true; and if "K. P." had stopped there, and advocated this form of joint as one calculated to considerably reduce the danger of leakage, he would probably have carried the assent of most experienced men. This actually appeared to be his position at one point in the article, for he expressly disclaims anything more than "a comparative degree of excellence" for this form of joint. But unfortunately this reasonable position is very considerably qualified by the assertions

that the lead jointing ring is "relieved of all strains tending to disturb it" and the further implication that there is no leakage from the mains upon which the "Rigid" joint is used. Surely "comparative degree of excellence" is a much too modest description of a form of joint from which no leakage can take place.

We have only to consider a simple case to see exactly what happens to the "Rigid" as to other open lead joints in actual practice. Suppose the joint shown in Fig. 1 is supported upon blocks at comparatively short distances, say 4 feet apart, the joint itself being midway between the supports. The pipes themselves are not absolutely rigid, but capable of bending. Assume that the joint is gradually weighted to, say, 3 or 4 tons. It is obvious that the joint would be depressed out of the true horizontal line. As a consequence of this depression, if the ends of the pipe are fixed, the joint will be drawn to a greater or lesser degree. Also, the portion of the lead packing ring at *A* will be more compressed than before, and the previous compression at *B*, due to setting up, will be somewhat relieved. If, now, the weight be removed, the pipe and lead ring will tend to recover their original respective positions. If, however, the same experiment be repeated a sufficient number of times, it will be found that the elasticity of both pipe and lead packing ring diminishes, but in unequal degree; neither regains exactly its original position, but takes on a permanent but unequal set. When this set becomes sufficiently pronounced there is bound to be a slight leakage between the surface of the pipe and the lead ring. Now, this loading and unloading process is continually going on in our streets, thanks to traction engines, steam rollers, tramcars and other forms of heavy traffic. Although, therefore, the "Rigid" joint may, to some extent, possibly to a considerable extent, relieve the lead packing of the strain due to loading which in the ordinary form of joint it would be subjected to, it appears too much to claim that the strain would be altogether and completely relieved.

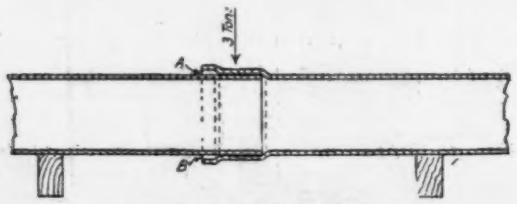


Fig. 1.—Loaded "Rigid" Joint.

There is also another way in which the "Rigid" joint would suffer, in common with every other form of open lead joint. This is from the unequal degree in which expansion and contraction take place in lead as compared with iron or steel for equal variations of temperature. These proportions are approximately as 17 to 7. Whether the "Rigid" or the ordinary form of joint be used does not, of course, affect this action in the slightest degree. To make the point perfectly clear, consider exactly what takes place in this respect. Assume that any particular main is laid in the summer time. The lead ring is then compressed into the annular jointing space by setting up at the temperature ruling at the time. In the succeeding winter, with its lowered temperature, the metals become contracted, and a further compression of the lead ring takes place. An accession of heat in the following summer causes expansion of both pipe and lead ring. As this takes place unequally, and as these movements are repeated year by year, the lead ring becomes more or less slack, or less tightly wedged, and in time allows of slight leakage taking place between the lead ring and the pipe. This action, again, is still further accentuated by the tendency of the lead ring to take permanent set after a succession of these operations. It is obvious that these results would attach quite as much to the "Rigid" as to the ordinary form of open lead joint.

It is, however, in dealing with the financial considerations that "K. P." will probably encounter most criticism. In view of the admitted fact that the greater part of the leakage in any ordinarily sound distributing system takes place in the services and service attachments, and, further, considering the importance of other factors in the leakage account, such as imperfect registration of meters, loss due to working upon the mains, public lighting, etc., it seems rather an exggerated estimate which, out of a total of 4,000,000 cubic feet of gas unaccounted for, places no less than 3,000,000 to the credit of leakages from the joints of the mains.

Accepting these figures as they stand, however, "K. P." goes on to show that the $1,250 per annum loss from this portion of the total leakage may be saved altogether by an additional expenditure on capital account of $750. Obviously, however, if the whole of this $1,250 is to be saved, there will not be the slightest leakage from any of the joints. These, on the estimate of "K. P.," would number about 4,000. But does "K. P." really intend to sustain the astounding claim that by using the "Rigid" joint, under the normal condition of our thoroughfares, there will not be the slightest leakage from any of the 4,000 gas main joints in a distributory system consisting of 20 miles of mains?

With respect to the use of lead wool for jointing, there is little doubt that a well made joint with this material is stronger, will resist greater loading strains and at higher pressures, and will also take up a greater amount of vibration without sensibly weakening than a joint made in the usual manner. The reason is at once apparent from the fact that, whereas the cast lead ring in the ordinary joint is compressed by setting up for only, say, ¼ inch from the face, the lead wool packing is wedged tightly home throughout the whole depth of the material. In this way a greater strength may be obtained with lead wool from an equal depth of lead, or, conversely, an equal strength with a less weight of lead wool.

In joints made with other material, however, the personal factor (the workman) and the degree of skill and care exercised in making the joints enter very largely, as a comparison of the following series of tests will show. To this the writer attributes the disappointing results obtained in the first experiment. With a view to testing the comparative value, under a loading test, of the two forms of joint, the writer has recently carried out the following experiments: Three 4-inch pipes were jointed together, one joint being made in the usual way and the other with lead wool. The joint *A*, Fig. 2, was made

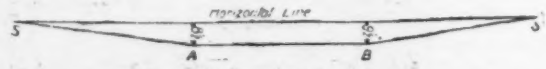


Fig. 2.—Result of Experiments with Lead Wool and Cast Lead Joint

with 2 inches of tarred yarn well driven home, the face of the joint being run in with molten lead to the depth of exactly 2 inches. The weight of lead used in this joint was 6 pounds 1½ ounces. The joint, *B*, was made of 2 inches of tarred yarn, well driven home, and the face of the joint, to the depth of 2 inches, was then made with lead wool. For this purpose 6 pounds 9 ounces of lead wool was used. The writer is, of course, aware that more lead was used in both these cases than there would be under ordinary conditions, the reason being that he wished to obtain as strong a joint in both cases as possible. The center blocks were then removed, leaving the pipes supported upon blocks 2 feet from each end, or 32 feet apart. The weight of the pipes caused each of the joints to become depressed, the joint at *A* (run lead) was depressed 1 inch, and that at *B* (lead wool) was depressed 1½ inches. Weights were then gradually applied exactly at the center point of the middle pipe until the total reached 17¾ cwts. The joint *A* (run lead) was then depressed to the extent of 8½ inches, and that at *B* (lead wool) was depressed 9½ inches. On removing the weights the joints were found to have taken permanent set at 1 inch less than the maximum deflection, or 7½ and 8½ inches respectively. Upon applying pressure after this treatment, it was found that the joint *B* (lead wool) began to leak slightly at 9 pounds per square inch, the joint *A* (cast lead) being still sound at 12 pounds per square inch.

It will be observed that in the above test the breaking point of the weaker joint was found, but that it was impossible to find the same point for the stronger, as both were on the same line of pipes. In order to avoid this disadvantage, another series of tests was made, culminating in that now to be described, Two separate sets of three 4-inch pipes were each jointed throughout, the first with cast lead joint and the second with lead wool joint. These will be spoken of as sets A and B, respectively.

Set A (cast lead joints).—This set was jointed upon wood blocks, the outer two of which were 32 feet 8 inches apart, center to center. On removal of the intermediate packings the pipes sagged by their own weight, the first joint to the extent of 14⅛ inches and the second to the extent of 13⅛ inches. Pressure was then put upon the joints, whilst still in this depressed position, by means of a hydraulic pump, by stages, until, at 250 pounds, the first joint commenced to sweat slightly. The pipes were then turned completely round, the original under side being brought to the top, and again they were allowed to settle down by their own weight, until the joint became depressed below the horizontal line to the extent of the original depression. One joint had then moved through 29¼ inches (14⅛ by 2) and the other through 26¼ inches (13⅛ by 2). Whilst in this position the pressure was raised progressively to 100 pounds per square inch, at which point

joint 1 began to leak slightly, whilst joint 2 remained tight. The pressure was then raised to 250 pounds per square inch, and whilst the first joint began to leak to a rather greater extent, joint 2 remained tight. When the pressure was raised to 300 pounds joint 2 began to show signs of sweating. At a pressure of 400 pounds per square inch the second joint began to drop gently. On the joint reaching the ground, a further depression of 1½ inches, and thus obtaining some support, the sweating stopped, and the joint recovered its soundness. This it maintained until, at a pressure of 450 pounds per square inch, the final bursting of joint No. 1 put a stop to the experiment. At this point the lead of joint No. 2 was drawn ⅝ inch at the bottom and No. 1 was drawn ¾ inch at the top and 1½ inch at the bottom. It seems rather strange that two joints made by the same man, under identical conditions and at the same time, should have varied so much in their capacity to resist the tremendous strains to which they were subjected as the two referred to in this experiment. The exact depth of lead used in each joint was 1½ inches, the weight being 4 pounds 9 ounces.

Set *B* (lead wool).—The depth of lead wool used in these joints was 1½ inches, and the weight 4¼ pounds in each, and the outer supports were at the same distance apart as in the former experiment, namely, 32 feet 8 inches center to center.

On removing the inside supports, the pipes sagged, by reason of their own weight, to the extent, at joint 1, of 4¼ inches, and at joint 2 of 4⅜ inches. In this position both joints were tight at 250 pounds pressure per square inch. A weight of 9¼ cwts. was then applied at the center point between the joints, which caused the joints to sink, No. 1 to the extent of 13¾ inches and No. 2 to 13⅝ inches. The first joint then was broken slightly, and the second showed slight signs of disturbance. The pressure was then raised by increments of 50 pounds to a total of 500 pounds, at which point No. 1, though drawn ½ inch, was still tight, whilst No. 2, which showed less sign of cracking, began to leak slightly. On the pressure being raised to 600 pounds the leakage at No. 2 became more pronounced, whilst No. 1, although drawn ½ inch at the bottom, still remained tight. On removing the weight of 9¼ cwts. the joints recovered their depression, No. 1 to the extent of 1 inch and No. 2 to the extent of 1½ inches.

The pipes were then turned completely over, as in the case of the previous set, and in that position both joints were tight at 400 pounds pressure. The pipes were then allowed to drop to the horizontal, in which position the joints were still tight at 400 pounds pressure. The pipes were then allowed to drop by their own weight to 12¾ and 12⅝ inches below the horizontal, respectively, and although No. 1 was drawn ¾ inch and No. 2 ½ inch, both joints were tight at 400 pounds pressure. The pipes were then vibrated over a movement at the joints of 1½ to 2 inches, and under this severe treatment (severe after what had preceded it) the joints both showed signs of weakening, No. 1 rapidly drawing until bursting point was reached. When this occurred No. 2 had drawn to the extent of ⅝ inch. In view, therefore, of the very exceptional treatment to which these joints were subjected, and which they withstood so well, there can be no doubt as to the value of lead wool as a thoroughly reliable jointing material when used by an experienced and capable workman.

Further tests with the "Yarrow" joint have also yielded some very interesting results. Two 7-inch pipes, flanged and stopped at either end, were jointed with the new "Yarrow" asphalt jointing compound, and proved perfectly air-tight at a pressure of 40 pounds per square inch, although the internal pressure had so compressed the asphalt core as to allow of an elongation from flange to flange of ⅝ inch. The center supports were then removed, the pipes resting upon blocks 15 feet apart, the joints being exactly in the center between the two. The weight of the pipes caused a deflection of 3⅝ inches. In this position the bottom of the joint was found to be drawn 1½ inches, and even then was perfectly tight at a pressure of 40 pounds per square inch. The position of the pipe then is shown in the scale drawings of Fig. 3.

The position of the pipes was then completely reversed, the original bottom becoming the top, as shown in the lower portion of Fig. 3. Even after this rough usage the joint was sound at 40 pounds. On removal of the center supports the weight of the pipes caused them to straighten again. When they had fully recovered the horizontal position, the joint was found to have drawn to the extent of ¾ inch, as shown in enlarged section in Fig. 4. All this time the pipes were under a pressure of 40 pounds, without a sign of leakage. When the joint had passed through an extreme movement of 8½ inches (3⅝ before reversal of pipes, back again to horizontal, and 5 inches below), as shown in the enlarged section at Fig. 5, the joint fractured. After taking the pipes apart it was found that the asphalt core had been sheared completely through longitudinally. Figs. 6 and 7 are copies of photographs of the spigot and socket of the joint, showing part of the asphalt core still attached to each. There can be little doubt that had the ends of the pipes been fixed, thus preventing any lateral

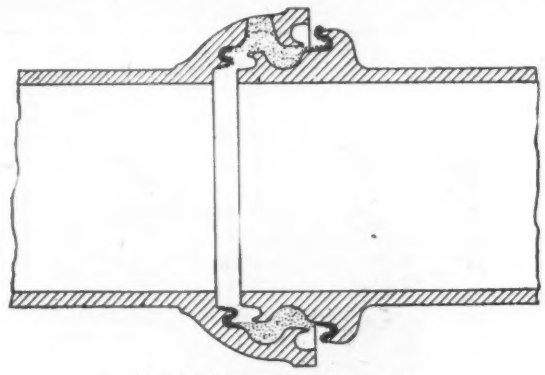
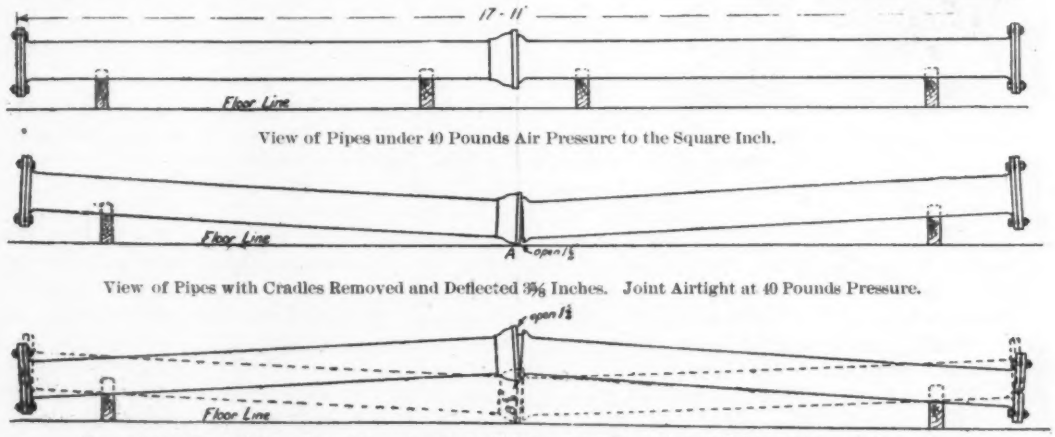


Fig. 4.—Yarrow Joint Under Test.



View of Pipes under 40 Pounds Air Pressure to the Square Inch.

View of Pipes with Cradles Removed and Deflected 3⅝ Inches. Joint Airtight at 40 Pounds Pressure.

View of Pipe Turned Over, then Allowed to Deflect by Own Weight. Joint Airtight at 40 Pounds Pressure.

Fig. 3.

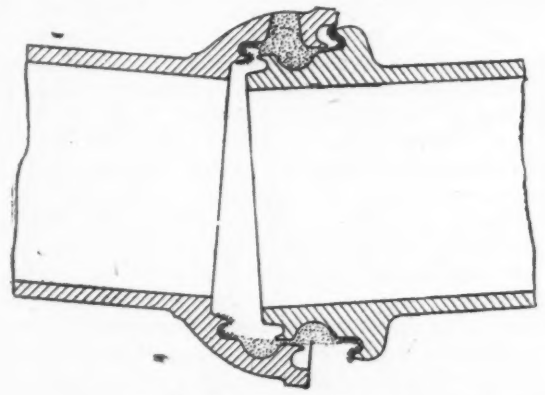


Fig. 5.—Yarrow Joint Under Test.

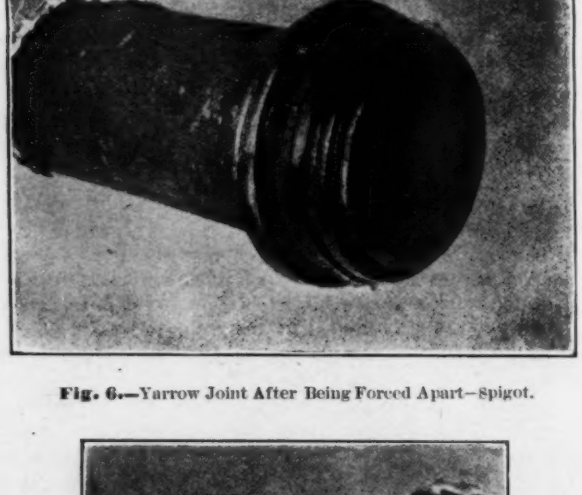


Fig. 6.—Yarrow Joint After Being Forced Apart—Spigot.

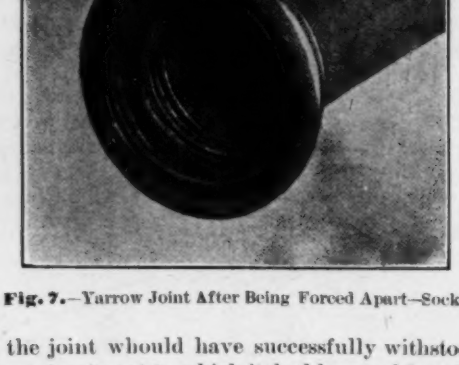


Fig. 7.—Yarrow Joint After Being Forced Apart—Socket.

movement, the joint whould have successfully withstood the exceptionally severe treatment to which it had been subjected.

As the "Yarrow" joint simply takes the place of the socket and spigot of the ordinary cast-iron pipe, we have here a combination of the strength and durability of cast iron in the pipes with a joint of such flexibility as will readily take up the vibrations to which it may be subjected; which will readily accommodate itself to possible subsidences of the subsoil; which will take up in itself the movement due to expansion and contraction; and which will effectually resist the loading strains due to heavy traffic. The writer is, however, unable to say, at present, to what, if any extent, the new flexible compound may be attacked by the gaseous constituents or the condensable vapors of various grades of gas.

Relative Economy of Steam and Gas Power When Exhaust Steam is Used for Heating.

[Prepared for the Fifteenth Meeting, Ohio Soc. M.E. and S. Engineers, by Mr. F. W. Ballard.]

The present time, when the gas engine is becoming so popular, is a good one to make a comparison between the cost of power generated by the gas engine and the cost of power from steam, when conditions are such that either the heating of buildings or the carrying on of some of the processes of manufacture can be accomplished by the use of exhaust steam from the steam engine.

It is generally conceded that when the power alone can be used, and the waste heat from the steam engine and gas engine is not utilized, the gas engine is the more economical power producer. This is no doubt true under the usual conditions, for the gas engine has the advantage of being the most economical prime mover we have as far as fuel consumption is concerned. It has also been shown that in a modern, well designed gas engine plant the cost of maintenance need not be more than half what the cost of repairs would be in a steam power plant of the same capacity; the cost of labor also would probably not run much over half what the service account would total in the steam plant.

Cost of Fuel.—However, it is not always possible to use as cheap fuel in the gas engine as can be found available for consumption under the boilers of the steam plant. We can use the cheapest grades of coal to advantage for the generation of steam; but we must manufacture gas for the gas engine, if natural gas is not available; and while the best result we can get with the highest type of steam plant is 1-horse power hour for about 20,000 heat units, we can get the same power from the ordinary gas engine with the consumption of only 9,000 or 10,000 heat units. Yet this vast difference in economy may easily be offset by the difference between the cost of the coal and the gas.

Twenty cents per 1,000 is about the lowest limit we can reach in the manufacture of blue water gas, and 30 cents per 1,000 is the price which must be paid for natural gas at nearly every place to which it has been piped in this State; and these prices, namely, 20 cents for artificial and 30 for natural gas, are not far from the same value per heat unit, natural gas having a thermal value of about 1,000 B. T. U. per cubic foot, and coal gas about 650.

If 1 brake horse power hour can be produced by the gas engine with 10,000 B. T. U., as we have just stated, this would mean a consumption of about 10 cubic feet of natural gas, which would represent a cost for fuel of about 0.3 cent. Assuming a cost of coal of $1.50 per ton, which is a fair average for the grades used in the general run of power plants, and a thermal value of 14,000 B. T. U. per pound, we find in the steam plant mentioned above, which is generating 1-horse power hour on 20,000 heat units, that the cost for fuel will amount to about 0.1 cent per horse power hour. Thus, under the conditions which are most generally found in the great majority of power plants in this State, the cost of fuel in a steam plant would be less than the cost of fuel in a gas engine plant of the same capacity.

Comparison for Steam and Gas Engine Plants.—The above figures are to a large extent theoretical, and would, no doubt, be difficult to realize in both the steam and gas engine plant under the practical conditions of continuous operation. In this connection some information given by Mr. J. R. Bibbins in a paper read before the American Institute of Electrical Engineers in December, 1903, is particularly valuable, as it consists of records of results obtained from the operation of a number of electric light and power plants using gas engines as their principal motive power. The records extend over a long period, and give a fair average of the cost of power in the station.

It is interesting to note that in 11 of the plants described in this paper, the records on the operating costs of which covered a period of from 4 to 9 months, the cost of gas at the engines, which consisted principally of artificial gas manufactured from coal, averaged 33.9 cents per 1,000 cubic feet; and the cost for gas averaged 1.4 cents per kw. hour.

Two of the plants described in the paper referred to are particularly valuable for our purpose, as they furnish data upon the comparative economy of gas engine and steam engine plants. In this instance, two independent stations were operated, one with steam engines and the other with gas engines run in connection with a gas works. The cost of fuel in the steam plant was 1.38 cents per kw. hour, and in the gas plant 0.75 cent per kw. hour.

In this plant Mr. Bibbins estimated that 92,000 heat units were required per kw. hour in the steam plant, and only 29,100 heat units in the gas engine plant. These figures represent the average results as shown by the records for a year's run. Both these plants ran from 15 to 18 hours per day, the steam plant consisting of compound condensing engines and water tube boilers. The steam plant was of 1,250-horse power capacity, and the gas engine plant of 685-horse power. Another plant described in this paper, having about 800-horse power capacity and operated, during the period covered by the records, first by steam engines and afterwards by gas engines, showed the following results: The total fixed charges on the steam plant, including interest on the investment, depreciation on buildings and machinery, taxes, insurance, etc., amounted to $22.30 per brake horse power per year. The net operating cost was $36.40, making a total cost of $58.70. In the gas engine plant the fixed charges amounted to $15.20 per brake horse power per year, and the net operating cost was $14.80, making a total cost for power in the gas plant of $30.50 per horse power per year.

These figures are certainly favorable to the gas engine plant as far as the cost of operation is concerned, and I believe that it is generally conceded that where it is not necessary to use exhaust steam for heating, and where reliability in the way of continuous operation is not necessary, the gas engine has the advantage.

Exhaust Steam for Heating.—However, the feature which gives the steam plant a decided advantage over the gas plant in the way of economy is the possibility of using the exhaust steam from the engine for heating. Of course, this precludes the use of condensing apparatus

in connection with the engine, and consequently lowers the economy of the steam plant considerably; but since the latent heat contained in the exhaust steam amounts to about 80 per cent. of the total heat of the steam before going to the engine, the lowering of the efficiency incident to running the engine non-condensing becomes of minor importance. In fact, it would be more proper for us to consider the power generated from the steam before its goes to the heating system as a by-product of our steam heating plant.

Of course, there are a great many plants in operation at the present time where it is not possible to make use of the exhaust steam, but by far the great majority are situated ideally for profiting in this way. All power plants in large office buildings, for instance, come under this class; and most manufacturing companies have buildings to be heated which will utilize most, if not all, of their exhaust steam. In addition to the heating of buildings, a great many of the manufacturing concerns can make use of the heat of the exhaust steam for carrying on certain processes necessary in their work, thus saving the use of live steam.

Live Steam, with Exhaust.—Even in cases where the temperature necessary is higher than that of steam at atmospheric pressure, it is not only possible but perfectly feasible to use the exhaust steam for bringing the temperature up to a certain point, and then to supplement by the use of live steam, thus making a great saving on what might otherwise be a very expensive operation.

In the dry color works of the Chicago plant of the Sherwin-Williams Company, we have some good opportunities to make use of this principle. In some of the processes it is necessary for water in large quantities to be brought to the boiling point. This we have arranged to accomplish by drawing the water from a tank through which pass coils of pipe in connection with the exhaust steam heating system. If capacities are properly figured, the temperature of the water on leaving these tanks is close to 200° F., and it is only necessary to increase it from 12° to 15° by the use of live steam. If we assume that the average temperature of the cold water was 60° F., which is probably about correct, as the water being supplied from artesian wells, the amount of live steam necessary to bring the water to the boiling point is only about 10 per cent. of what it would be were it heated entirely by the use of live steam.

Drying Ovens.—Another instance of using exhaust steam supplemented by the use of live steam is in drying ovens where exhaust steam does not give a sufficiently high temperature to produce the desired results. In this case we bring air for drying into the ovens, passing it over coils connected to the exhaust steam heating system. The temperature of the air is approximately 200° F. on entering the ovens. Live steam coils are then placed in the ovens, located just as if no auxiliary heating had been done with exhaust steam. In this case the percentage of saving is not so great as in the first, because the ultimate temperature desired is higher, but the saving in dollars runs into the thousands.

Heating Buildings.—The use of exhaust steam for heating buildings has come to be such a familiar thing with a great many engineers that they look upon it as a natural function of the steam power plant; and yet, in figuring costs, it is very seldom taken into consideration.

In a paper presented by the writer at the Toledo meeting of this Society in May, 1905, a system of power plant accounting was described in which a method is used for determining the amount to be charged against departments and buildings for heating by exhaust steam, together with the consequent credit to be made to the power plant for this service. It is, of course, necessary, in order to arrive at the correct cost of steam power, to make the proper charges for any and all uses to which either live or exhaust steam may be put, and the corresponding credits back to the power plant give us the net cost of power.

Charge for Heating.—The charge which we make to the different buildings and departments for the use of exhaust steam for heating is at the rate of 2 cents per month per square foot of radiating surface for 6 months in the year. The charge for live steam which it is necessary to use for various purposes is generally determined by taking the amount of condensation for a certain period of time or for a certain operation, and then estimating the proportion of the total steam generated in the power plant which is being used in that department, and making a charge to the department each month for that proportion of the total cost of operating the boiler room. This amount includes the cost of coal delivered at the boiler, boiler room service, boiler room maintenance, insurance, supervision and administration charges, removing ashes, etc.

Radiation Required.—In figuring the radiation required in any building, when great accuracy is desired, the formula given by Prof. Carpenter, of Cornell University, in his book "Heating and Ventilating Buildings," is generally used:

$$h = \left(\frac{n\,C}{55} + G + \tfrac{1}{4}\,W\right)$$

in which

h = B.T.U. required per hour.
C = contents of room in cubic feet.
n = number of times air shall be changed for ventilation.
G = glass area in square feet.
W = outside wall area in square feet.
t = difference in temperature between the air in the room and outside.

However, for ordinary practical purposes, a rough calculation may be used. One square foot of radiation for each 4 to 5 square feet of floor space will be required for offices or rooms where persons are employed at sedentary occupations, while 1 square foot of radiation for each 5 to 6 square feet of floor space will be all that is required for factories and rooms where persons are employed at manual labor, and 1 square foot of radiation for from 8 to 10 square feet will be sufficient for warehouses, where the only heat necessary is enough to keep water pipes from freezing.

Steam Required.—I find in practice that, on an average, when a full head of exhaust steam is maintained upon the radiators, about 250 heat units are radiated per hour per square foot of radiation. This amount is approximately correct as per Carpenter's tables, when the difference between the temperature of the radiator and the air in the room is 150° F. According to the same authority, the amount of steam condensed per hour per square foot of radiation would be about 0.25 pound, or, in other words, 1 pound of steam would supply 4 square feet of radiation.

I find in practice, however, that in using exhaust steam 1 pound will supply only about 3 square feet of radiation. Assuming this amount to be correct, and that the engines in the power plant will consume 30 pounds of steam per horse power hour, then 1-horse power capacity in the power plant would furnish exhaust steam enough to heat 450 square feet of offices, 600 square feet in the factory and 900 square feet in the warehouse.

Fuel Required and Cost.—If we figure that 1 pound of coal will produce 8 pounds of steam, it will supply exhaust steam to about 25 square feet of radiating surface for 1 hour, and if coal costs $2 a ton, the fuel necessary to supply 1 square foot of radiation for 1 month, making proper allowance for the value of the steam used in the engine, will cost about 1 cent, assuming that we supply steam to the radiator for only about 10 or 12 hours per day.

Also, assuming that the amount of boiler room expenses will just about equal the fuel cost, we are justified in estimating our cost for exhaust steam at 2 cents per square foot per month during the months when heating is necessary. I do not believe that very many heating plants can be operated for heating alone, and supply live steam for this purpose, and get under a cost of 2 cents per square foot per month.

After making the proper credit to the total cost of power generation for live and exhaust steam as outlined above, we have been able, in some of our plants, to produce electrical power at the switchboard for 1.5 cents per kw. hour. This, I believe, is better than can be done in any plant of the size we are operating by using gas engines, and particularly so when it is taken into consideration that, if we used gas engines for power, it would be necessary to operate a boiler plant to generate steam for heating and for the many other purposes to which we put it.

Use of Compound Engines.—There are great possibilities along the line of using high-pressure compound engines for power which can be operated either condensing or non-condensing, so that they can be run condensing in the summer time, or whenever the exhaust steam is not needed for heating, and operated non-condensing the balance of the time.

We recently installed a 300-horse power Westinghouse compound engine in our Newark factory, to be run on 150 pounds steam pressure, non-condensing. This is now operating on an average of about 23 pounds of steam per horse power hour. The idea in this is all right as far as it goes, but I consider that a later installation which we have just made, of a 300-horse power compound engine in our Chicago factory, which can be run non-condensing when we need exhaust steam and condensing when we do not need the steam, is a step still further in advance.

Heating from Gas Engines.—So far, we have given no credit to the

gas engine for the possibility of using the heat of the exhaust gases for heating buildings. That there is such a possibility cannot be denied, but it is limited because, first, of the low fuel consumption of the gas engine per horse power hour, and, second, the large percentage of the heat units contained in the fuel which are converted into power. In a simple non-condensing steam engine using 30 pounds of steam, there are about 30,000 heat units contained in the exhaust steam for each horse power hour, and this would supply about 90 square feet of radiation after due allowance for losses in the supply pipes, steam for heating feed water, etc., had been deducted.

The waste heat in exhaust gases from the average gas engine would contain about 6,000 heat units per horse power hour, which would be available for use in heating, and would supply only about 20 square feet of radiation, after due allowance for losses. About half of this heat would be contained in the jacket water, and probably the easiest way to utilize the total heat available would be to put the exhaust gases through a tubular heater and combine the jacket water with the water from this heater in a hot water heating system. I have seen accounts of a number of gas engine plants where hot jacket water has been used for heating, and I believe that there are a few instances where the heat of exhaust gases has been still further utilized by heaters as outlined above; but the possibilities of any extensive heating systems being installed along these lines are, no doubt, limited.

Summer Kitchens.

Editor Livingston, in the clever number of *Gas Logic* for August, has this to say respecting the subject named in the heading:

Those of us who have been so fortunate as to have country homes know what a comfort a summer kitchen is, whether in a small building apart from the house, in Southern fashion, or in an extension opening shed-like from the usual kitchen, as New England custom has it. The summer kitchen takes out of the house the heat and discomfort of the heavier work and makes summer a more delightful season.

In a city house the summer kitchen is the same as the winter kitchen, and whatever difference there may be between the two is due to the housewife's planning.

The gas range is an important element in summer arrangements. Comfort in kitchen work during warm weather is well nigh impossible without it. But there are ways and ways even of running a gas range.

Coolness in a city house is far more important than in the country, since there is no garden to which to flee, and whatever enjoyment is possible in the evenings at home must be had in the living rooms. Every care, therefore, should be taken not to let these become heated, and with a gas range in the kitchen, and forethought in planning the meals, comfort can be secured even when dinner for a family is prepared at home.

A thorough revision of the menu is the first thing to be considered. Cut out absolutely all or nearly all of the dishes which require frying. Croquettes, fritters, fried bacon and French fried potatoes are out of place in the bill of fare of any house where smells from the kitchen can possibly penetrate to the other rooms. Roast, broiled and braised meats are in order, fresh or canned vegetables cooked with the windows let down at the top and a good current of air to carry off odors, and all salads and desserts which can be prepared without cooking, or made during the morning hours and set away in the refrigerator. Fruit is not always suitable for hot weather in its raw state, and gives some people indigestion. When this is the case it is better to use berries and peaches and green apples in the form of freshly made sauce, puddings or properly made pies. Nobody would expect to stoke up a furnace and then find it cool in the cellar, and to eat during July and August the heat producing foods which were good for the winter months is just about as sensible.

In the use of the range, it is wise to use the oven as little as possible. Choose a cool day to heat the main oven, and roast enough meat, and prepare enough pies or puddings, at one baking, to last 2 or 3 days. For rechauffés, small puddings, biscuits or muffins, use the tin oven over one burner.

With a sheet iron plate over the burner, an entire ironing may be done without lighting more than one jet, for three irons will easily heat on the one plate, and that is enough to keep anybody supplied. If two are ironing at once, a pyramidal iron-heater will keep five irons going. In boiling clothes, two burners may be lighted under the boiler to heat the water, but one alone will keep it boiling. In cooking, it is important to remember that gas does not need to be turned on full head in order to keep water boiling for meat or vegetables, and that water which boils cannot get any hotter in an ordinary saucepan. To keep it bubbling furiously cooks the food no faster and wastes the heat.

There are many other ways in which to save heat and keep the kitchen comfortable, but the most important thing is to seize cool weather when it comes, and reserve heat making dishes so far as possible for such a time.

Sparking Plugs.

Some weeks ago, Mr. E. W. Walford, writing in *Engineering*, of London, reported the result of some tests of a small De Dion engine, which were carried out in order to compare the results in regard to fuel consumption obtained with magneto and accumulator ignition systems. The engine was a small air cooled one of 66 by 77 mm. bore and stroke. It was fitted with the ordinary De Dion spring contact maker, the current being supplied by a 4-volt accumulator in one case and by a magneto coupled to the engine in the other.

As the apparatus is a very simple one, and can be fitted up and used by almost anybody, it is described somewhat fully.

The carburetter used was the old De Dion triangular surface carburetter. This was fixed to a board which was slung from a beam pivoted and supported by a sensitive spring balance. A counterbalance was arranged and was loaded so as to bring the beam horizontal and pointer placed at the center of the beam into the zero position. As the gasoline in the carburetter was consumed, that end of the balance rose, and by reading off from the spring balance figures were obtained which could be converted into consumption units.

The carburetter was then connected to the engine through a flexible hose pipe, and the throttle and rotary air valves were operated by slides, which could be clamped in any position by wing nuts. During the tests the engine was run with the throttle fully open and the spark up to its work, but the air adjustment was varied until the best results were obtained.

The best results were obtained with storage battery ignition and no external spark gap, the consumption being .187 of a gallon per B.H.P. hour. The worst result was obtained with a magneto with an external spark gap, the figure being .289 of a gallon per B.H.P. hour. By adding an external spark gap to the storage battery system the consumption fell off to .226 per gallon per B.H.P. hour. These figures are hardly satisfactory, but they are not without interest. It was found that the difference in the results obtained with the two systems was very small, and as the authors in their report state that some of the results were obtained when the magneto was driven by the engine, and others when the magneto was not coupled, it seems that the test was hardly a fair one in some respects.

It will be seen that the consumption tests were made with a surface carburetter, but there seems to be no reason why similar apparatus should not be used with a spray carburetter. In such a case the gasoline tank or container would be mounted on the board and connected by a flexible rubber or other pipe to the carburetter. The beam should then be balanced after the engine has been running some time with the carburetter full. If the test is finished up under conditions similar to those which obtained at the commencement of the test, the results would be as accurate as would be necessary.

The experiments of greatest interest to the motorist were those made in connection with the sparking plug itself. It was found that, in spite of the engine being provided with a fan to direct an air blast on to the cylinder, the sparking plug became hot and the engine overheated. That is to say, it was found that misfiring was set up when the engine got hot. Fitting an external spark gap overcame this misfiring. The sparking plug was then wrapped in asbestos and heated artificially by means of a spirit lamp, and it was found that above certain temperatures the sparking plug refused to fire across the gap—in fact, it short circuited through the porcelain. By fitting an external gap, sparking across the gap was obtained in all cases. The sparking plug was then arranged so that it could be switched across from the induction coil to a high resistance testing plant, by which the electrical resistance of the porcelain could be tested at any moment.

Starting with the sparking plug cold, the resistance was something above 1,000 megohms. After running the engine normally for 5 minutes this fell to 6 megohms. At the same time the sparking di

minished considerably in intensity, until it stopped entirely. The introduction of an external spark gap immediately restored the sparking between the points, even when the resistance of the porcelain fell to .5 megohm, the plug being then at a bright red heat. The external spark gap was then removed and the plug allowed to cool. When the resistance was 5 megohms the plug had just ceased to glow.

This points out that as the sparking plug warms up the tendency to short circuit through the insulation increases until the resistance of the insulation becomes less than that of the air gap, especially when under compression. From this one might deduce the fact that when overheating occurs the sparking plug should either be kept as cool as possible or changed from time to time, or that an external spark gap should be fitted. These external spark gaps have fallen into disuse, but they are simple little devices which can easily be made and fitted, when the above experiments can in many cases be easily performed by almost any motorist.

The next experiments were carried out to ascertain the exact position in the stroke at which firing took place. Paper disks were fastened onto the engine pulley, and arrangements were made so that the spark passed between a wire point on one side of the paper and through the paper to earth. The spark thus had to puncture the paper to complete its circuit. The contact breaker was adjusted so that the spark punctured the paper when the piston was just at its top dead center. The engine was then driven at a speed of about 1,300 r.p.m. (presumably by power) and a succession of sparks allowed to pass through the paper. It was found that the sparking point was retarded at the above speed by 30° to 32°, corresponding to a retardation of nearly .1 of the stroke.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, August 10th, 1907.

The Coalite Prospectus.—Two Papers on the Sale of Gas.

Since writing on the subject of coalite in June, I have received a copy of the prospectus issued by the British Coalite Co. The capital is two millions sterling, divided into 1½ million ordinary shares of £1 each, and ½ million deferred ordinary shares of similar face value. The capital is to be applied for the purchase of the patent rights of freehold properties at Barlung and elsewhere, for the construction of coalite works, the payment of preliminary expenses, and for working capital. The public are invited to subscribe for the 1½ million ordinary shares, and the whole of the purchase consideration is taken by the vendors on deferred ordinary shares. In the prospectus coalite is described as an improved coal, obtained by distilled ordinary coal at a low temperature, thus removing all the smoke producing matter without overheating the carbon. The process does not break down the hydrocarbons, so that nearly a double yield of valuable liquid hydrocarbons is obtained, and about half the volume of gas usually extracted in gas works. The treatment of coal so as to produce primarily a first rate domestic fuel, and at the same time a larger yield of liquid by-products, and a notable quantity of high power gas, is considered to be a new principle of the highest public importance. Coalite has been declared by the Smoke Abatement Society to be absolutely smokeless and greatly superior as a fuel to coal of the best quality. Amongst the advantages claimed for domestic use are the radiation of more heat into the apartment, no smoke or soot, so that chimneys and flues do not require sweeping, quick lighting, burns up brightly immediately, and keeps a clear glowing fire for many hours without attention, can be burnt very low without extinction, heats a room more cheaply, and can be used in any form of grate or stove. The reason for the practical superiority of coalite, in spite of the fact that according to the calorimeter its value is about the same as coke, viz., 13,500 B. T. U. per pound, while coal is 14,800 units, is stated to be that a larger proportion, nearly the whole, is on combustion converted into useful heat, while when coal is burned in the domestic grate the heat first generated is partly used in decomposing and volatilizing the hydrocarbons of the coal and in driving out the water. Until this action is completed, the fire burns dead and the amount of radiant heat thrown into the room is but small. The result is that the solid residue is left in the grate, and the gases and liquids driven off as vapors, which burn above the body of fuel, create a rush of air to the chimney, thus causing smoke but doing little towards heating the room. Experiments show that in the preliminary decomposition and volatilization, the heating value is so reduced that by the time the fire is clear only a little over 50 per cent. of the total calorific value of the original fuel remains. So that in actual practice the relative values are more like 7,500 and 13,800. The price at which coalite can be sold should always be less than that of coal, not only because of the by-products, but because cheaper qualities of coal can be used than are salable in the ordinary market. The 13 million tons of bituminous coal at present consumed per annum in London, of which about one-fourth is wasted through imperfect combustion, with production of smoke and soot, could for the most part be advantageously replaced by coalite. The report goes on to state that as the result of authoritative experiments at Wednesford, the treatment of only 3 millions of coal a year would yield a profit of half a million sterling. Most of the statements above quoted are corroborated by the reports of experts included with the prospectus.

I have preferred to quote the principal headings of the prospectus without comment, so that your readers can form their own opinions, and as coalite is likely to be placed upon the market, it is better to leave it in that position and to await developments. The Gas Light and Coke Company are putting a similar fuel on the market under the title of "Carbo," and a leading gas engineer has stated that there is no patent on coalite, but that any gas company can make it if it suits their purpose to do so. Tho questions of particular interest from our point of view are, assuming the coalite to be a practical success, what is to be done with the excess of gas and what is going to be the effect on the coke trade? As regards the liquid products, we shall be interested in seeing if they can be made to yield a better return than gas tar. We may also consider the effect of a large coalite demand on the coal market. The qualities of coal described as "cheap" occupy that position because it is difficult to find a demand for them and because they are really a kind of residual from screened coal. A big drop in the demand for better class coal, and at the same time a large increase in the demand for cheap coal, cannot but have a decided effect on market conditions. Collieries are not run for the production of small or slack alone, but depend mainly upon the demand which coalite aims to displace. Gas is all very well as a primary, but might prove awkward to deal with as a residual product. This difficulty has already risen in connection with coke ovens in Germany, where an auxiliary gas works has proved a necessary addition to the coke oven plant. Gas cannot be stored to any extent, and the demand fluctuates with the temperature and the seasons, and it might be a difficult matter to get the demand for the primary product to keep pace with it.

The only apparent difference between coalite and the coke made in iron retorts in a small village or private gas works, when carbonizing temperatures in the neighborhood of that claimed for coalite are not an uncommon thing, is that no water is used for its extinction. And this suggests the idea, whether many if not all the advantages claimed for coalite, could not be obtained by smothering ordinary coke instead of drenching it. The red-hot charges might be drawn into receptacles capable of being closed, and the cooling facilitated by application of water to the exterior. In the laboratory it is very usual to draw a charge in this way, or to place the charge to be tested in a sheet iron box fitting the retort, the charge being pulled out on to a slab flush with the mouthpiece and instantly covered from the air. The object of this arrangement is to avoid loss of coke either by spillage or combustion after drawing, but the point with which we are now concerned is that the coke so prepared is as superior to ordinary coke as freshly wrought coal is to a sample that has been exposed in an open yard for several months. Why should it not be possible to secure coalite without sacrificing half the yield of gas?

An interesting novelty was furnished to the profession in a paper read by Mr. James Campbell at the recent meeting of the North British Association of Gas Managers, whose experience is one that is not often to be met with at this time of day. It comprises a careful, well arranged account of his experiences in inaugurating a gas supply at Polmont, and is none the less interesting because the author appears to have taken a personal part in the whole of the operations concerned. He has built the works, laid the mains, canvassed the consumers, and filled the orders when obtained, securing practically the whole of the gasfitting trade. In a few instances where parties preferred to employ their own fitters the pipes have been laid to his specification. A result of this has been the entire absence of "complaints" as usually understood at the gas works. Mr. Campbell is not a follower of the latest ideas, which are sometimes included under the term "up-to-date," but has gone about the business in a quiet way, using ordinary

everyday methods that might be taken up in any gas office without attracting public attention, and probably thus placing his new business on a more solid and enduring foundation than is possible by quick time methods, which are likely to encourage a restless and changeable temperament. Gas companies generally are beginning to find that one disadvantage of fixing appliances free of first cost, is that many people will have the whole kit, although they do not require it for regular use, and another is that some customers are most unreasonable in the matter of changes. They see a cooker of a different pattern to that supplied to them at a neighbors and are set on having one like it. All sorts of complaints are made against the existing apparatus, and perhaps they threaten that if they cannot have what they want they will dispense with gas altogether. If their wishes are acceded to they will be round again in 6 months time on some other pretext. So wherever schemes of a free nature are in use the parties responsible for giving out the order for the same must be impressed with two facts. One is that there is more expense involved in changing a meter or a stove than in fixing an additional one. And the second is that the fitting up of an appliance where the consumer orders it, and leaving it in efficient order, does not necessarily insure that it will be regularly used. It is very necessary to guard against a large accumulation of unused appliances at the works stores, as a large amount of capital may be rendered useless and perhaps lost. But it is not so apparent that a cooker that is only used to boil a kettle now and then, or a fixture that is not lighted up for an hour a week, is equally a source of loss. "Out of sight out of mind," is a very common saying and might be improved with "Out of mind, out of the balance sheet." Mr. Campbell appears to have appreciated these points and hence his success. The same applies equally to gas undertakings of all sizes. It is to the effect that quiet, homely tact and judgment brought into actual contact with the customers is far superior to all slap-dash enterprise. But it must not stop with the completion of the fitting up and the entry of the consumer's name in the proper place on the rental roll.

The Gas Light and Coke Company, of London, are taking up a position worthy of the largest gas company in the world, in the way of developing and carrying on their business. Some years ago I remarked that there was nothing of special interest to the profession to be gathered from their proceedings apart from the magnitude of the figures concerned. Things are very different now, and the speech of the Chairman and other proceedings at the half yearly meetings of shareholders are looked for and perused with the interest always attaching to the doings of a progressive and enterprising concern. The Company are also exercising a liberal spirit towards the profession. Their Chief Inspector, Mr. Goodenough, came before the Dublin meeting last month with a valuable contribution on the sale of gas, which is in many respects of a unique character, and should be carefully perused by all who are professionally concerned on the subject. Taken in conjunction with the paper referred to in the preceding paragraph, which deals with the sale of gas in villages, the reader who thoroughly assimilates the contents of the two papers and discussions will not have much more to learn. And Mr. Goodenough has further added to the great benefit conferred on the profession by his paper, in publishing, with the concurrence of the Chairman, the rules issued to the employees in his department who actually come in contact with the customers.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Hon. Frank E. Holden, President of the Woonsocket (R. I.) Gas Company, is at his desk, bright as a well polished button and healthy as can be. He spent about two months touring, principally round and through the British Islands, and while he saw much abroad that was interesting, instructive and charming, he nevertheless agrees with Captain McGregor that "Little Rhody" beats them all.

MR. DAVID FOX has resigned the post of General Manager of the Rutland (Vt.) Railway, Light and Power Company, which position he most successfully held since 1902. This action was prompted by the growing necessity for his personal supervision of business interests concerning him in Mexico. His successor is Mr. George S. Haley, who has had charge of the Company's electric lighting division since 1901.

A CORRESPONDENT forwards the following from Indianapolis, Ind., under date of the 24th inst: The following original recipe will be acceptable to all gas companies that desire to increase the popularity of the broiling oven of the gas range. As the recipe has not been copyrighted, it is furnished by Mr. Philmer Eves, the irrepressible, never-take-no Sales' Agent of the Indianapolis Gas Company, who secured the lines (with permission to publish them) when in Paterson, N. J., in which city Judge Senior was a well-known authority on the Broiling of a Beefsteak:

Preparatory Hints.—I. The porterhouse steaks used by the genial and capable Judge are 5 inches thick—the cut next to the hip bone.

II. Smaller steaks for smaller needs; judge the weight by that it feeds.

III.—If two or more steaks are broiled at once, they may be laid on the broiler in the form of a square, filling in the intervening spaces with salt.

IV.—When ordering the steaks, include the following: Celery, green onions, radishes.

Recipe.—I. Strike the match, and light the broiling oven burner. Oven ready in 5 minutes. No coal or kindling needed, and there will be no ashes, smoke, dust or further trouble.

II.—Pepper the steak very freely; then put on a layer of salt, nearly ¼ inch deep.

III.—Place the steak thus prepared in the lower, or broiling oven, on the broiler grid, within 3 inches of the economical blue flame.

IV.—Watch frequently, to avoid burning.

V.—Add salt, where dark patches show it is needed. Time for first side, about 30 minutes; shorter time of course, for smaller steaks.

VI.—Take steak out of oven and "shell off" salt and pepper.

VII.—Reverse and treat the under side in the same way, and serve as soon as broiled.

MR. NICHOLAS KORFF, a graduate of Freiburg (Germany) University, and for some time in the employment of the Westmoreland Gas Coal Company, will hereafter act as chemist for the Gas Companies at Meriden and New Britain, Conn., dividing his time equally between each.

HERE is something that is even worthy the consideration of the head of the New York City Police Department—the story was sent on by a correspondent in St. Louis, Mo., under date of August 24th: "C. A. McManie, a patrolman on our police department, saved the life of a plumber early this week, who was suffering from gas asphyxiation. The plumber (Eugene Lawler) was overcome by gas while working over a gas meter in a house on Manchester street. Luckily his condition was speedily noted and the named policeman was summoned. Getting right at work on the patient, by means of the arm and chest movements, so well known to gas men, consciousness was restored after an hour of laboring. The patient was removed to an hospital, from whence he was discharged, cured, the following day. The patrolman was formerly employed by the Laclede Gas Light Company, and the case reported is the third in which he successfully figured."

ACCORDING to the report of the Internal Revenue Bureau for the 6 months ended the 31st July, the proof sheets of which are now fast appearing, the division relating to denatured alcohol shows a product for the first half of the year equalling 1,774,272 gallons.

THE Utah Gas and Coke Company, through Mr. George A. Snow, has submitted to the authorities a proposition for the partial public lighting, by Welsbach lamps, of Salt Lake City. In all a service of 957 lamps is projected, these to cost, on a 3-year basis, $33 per lamp; on a 6-year basis, $31; on a 9-year basis, $30 each.

AT the annual meeting of the Peoria (Ills.) Gas and Electric Company the officers elected were: Directors, E. G. Schmidt, W. H. Brown, H. D. Walbridge, Walter Barker and F. H. Smith; President, H. D. Walbridge; Vice-President and General Manager, E. G. Schmidt; Secretary and Treasurer, Wm. H. Brown.

A WATER gas plant will be installed (replacing a plant of the acetylene type) at Peaks Island, Me.—a noted cottage summering resort. The owners of the franchise work under the title of the Peaks Island Gas Company.

A CORRESPONDENT in Boise City, Idaho, writing to us recently, says that the City Council of Coeur d'Alene, Idaho, has granted to John Carr and associates an ordinance under which they are empowered to

maintain and operate a gas plant to sell gas to the city and citizens of Coeur d'Alene. It provides that within 24 months not less than 5 miles of main must be laid; that within 9 months work must be begun; that the pipes are to be laid through the streets and alleys, which the Company is to keep in as good condition as when disturbed by them; to supply gas for public buildings at $1.25 per 1,000 cubic feet and citizens at $1.75 per 1,000 cubic feet; that when the cost of extension shows 6 per cent. the line must be extended; the rate charged to be fixed by a joint commission; the franchise for 40 years, but the city may purchase after 15 years, the price to be fixed by a joint committee; combinations with other light companies are prohibited; that the Company must give $5,000 bond for faithful performance and lay the pipe to the property line.

A MERGER of the interests of the Hattiesburg Traction Company, the Hattiesburg Electric Light and Power Company and the Hattiesburg Gas Company, all of Hattiesburg, Miss., has been announced. The name of the succeeding corporation has not been registered yet. It is capitalized in $500,000, and its officers are: President, A. Thomasson; Vice-President, H. S. Camp; General Manager, Z. C. Stevens.

MR. JAMES HAMMET, a pensioner of the old Boston Gas Light Company since 1902, died at his home in Malden, Mass., the morning of the 21st ult. Deceased, who was born in Manchester, England, May 11, 1832, came to this country when a boy, his parents settling in Malden in 1840. In 1850 he entered the service of the old Boston Gas Company, and in time worked himself up to a responsible position in its collection department, from whence he was retired with a pension. He served Mount Vernon Lodge as Treasurer for 27 years, and was also Treasurer to St. Paul's Episcopal Church, Malden, for a lengthy period.

MESSRS. J. R. PHELAN, C. A. Anderson and B. F. Belltheim have made application to the Alliance (Neb.) City Council for a grant which will enable them to operate there a gas and electric lighting plant.

PRESIDENT COPLEY does not seem to have forgotten the prowess of his days on Yale field, and we are so led to believe from the fact that at the annual outing of the men connected with the Aurora (Ills.) division of the Western United Gas and Electric Company a feature of the fun was a game of baseball between nines from the Aurora and Joliet plants. The score was 3 to 2 in favor of Aurora, and the deciding run was a "homer" made by the Colonel.

AT the annual meeting of the Woburn (Mass.) Gas Light Company the officers elected were: Directors, George E. Warren, F. H. Monks, R. J. Monks, L. H. Monks and G. H. Monks; President, T. H. Monks; Treasurer and Clerk, Richard J. Monks; Superintendent, John Gilcreast.

DURING a severe electric storm last month in Waterloo, Ia., a flash of lightning wrecked the turbine in the power plant of the Citizens Gas and Electric Company of that city, putting the apparatus out of commission for 24 hours.

ACCORDING to official figures the Portland (Ore.) Gas Company is earning at the rate of 8 per cent. on its capital stock. This is a surprising showing.

THE second annual entertainment of its employees by the Milwaukee Gas Light Company was a rousing success. It was brought off at Waukesha Beach the 21st ult., and 6 interurban trolley cars were required to move the force. Prominent in the management of the affair was Mr. Bryce McAdam, the Company's Engineer of Distribution, and Messrs. Cornish and Kraft were also well to the fore in seeing to it that everyone had a good time.

THE main extension by the New Haven (Conn.) Gas Company, to and through Branford, has been completed as far as Hillside avenue.

THE Mayor of East St. Louis, Ills., is again on the warpath for cheaper gas. In fact he wants to know why there should be any difference in the gas rates of St. Louis, Mo., and East St. Louis, Ills. What do you think of that?

THE Peoples Gas Light and Coke Company, of Chicago, Ills., has largely increased its real estate holdings in the vicinity of its Englewood plant.

LATE last month papers were served upon Mr. C. J. Root, as Treasurer of the Interurban Gas Company, of Geneva, in an action which the authorities of Seneca Falls have instituted against the Company to compel it to stand by its alleged pledge to supply gas to the residents of Seneca Falls at the uniform rate of $1.25 per 1,000.

A CORRESPONDENT in Salem, Ore., forwards the following: "Last month the City Council of Corvallis granted to Mr. James Steel and associates, of Salem, the right to manufacture and distribute gas in Corvallis for a period of 25 years. Work is to be begun on the construction of the plant forthwith, and a site for its location has been purchased right on the banks of the Willamette river. The maximum selling rate was fixed at 75 cents per 1,000 cubic feet. The distribution system will require the placing of perhaps 10 miles of pipe, and the contractors assert that 6 miles of this will be ready for use before the rainy season arrives. Other main points in the grant are that the Company must pay into the city treasury $100 per annum for the first 5 years of its operation, and 1 per cent. of the gross earnings per year the remainder of the life of the franchise. If the city wishes to purchase the plant after the first 5 years, it may, the price to be arbitrated. The Company is to give a bond in the sum of $5,000 and allow the inspection of its books by the city authorities."

THE following from a local paper, dated the last week in August, fully proves that the proprietors of the Queens Borough Gas and Electric Company, of Far Rockaway, L. I., are doing their best to keep up with the procession: "The replacement so far of several miles of 2-inch distributing pipe, by pipe of not less than 4 inches diameter, has had the effect of materially helping out the pressure conditions in Far Rockaway, which were rather annoying, to say the least, for some time back. The consumption of gas for last month averaged about 700,000 cubic feet per day, which output was in excess of that for the same month last year by 16 per cent. The lowest sendout this year was reported in March, when the output was something under 160,000 cubic feet per day. Nevertheless, that was a 15 per cent. excess showing over that for March, 1906. There are now in use from Far Rockaway to Belle Harbor, 3,500 meters. The Company will replace all the 2-inch 'mains' now underground with pipe at least 4 inches in diameter, which is certainly a goodly task, meaning a large expenditure. That the work, however, will be well and speedly done is certain, from the fact that the Sullivan Brothers, of Flushing, L. I., are in charge of the job."

MR. DENNIS J. HERN, Superintendent of the Lamp Department, City of Boston, reports that last year the public lighting cost the sum of $804,408.33, divided as follows:

	1906.	1905.
Electric lamps	$459,530.72	$442,757.41
Gas lamps	288,187.95	291,012.12
Naphtha lamps	56,679.06	59,453.94

Respecting the noted type of lamp, the Superintendent wrote: "The new triple-mantle boulevard gas lamps of 180-candle power, which the present administration has adopted to a large extent in lighting the boulevards and important streets, have given good satisfaction. A single-mantle, 60-candle power lamp is being placed in the alleys and courts throughout the city where there are entrances to tenement houses, and this has already shown good effect in the suppression of vice in and to the cleanliness of these localities."

THE Cincinnati Gas, Coke and Coal Mining Company has entered into contracts with the Kentucky Heating Company, of Louisville, Ky., and the Louisville Gas Company, under which agreement the former will handle all the coke product of the latter named concerns.

MR. WILLIAM DARBEE, who resigned from the post of Manager of the Albany and Hudson Railroad last month was, on the evening of the 23d ult., presented by the employees of the Company with a valuable scarf pin and a serviceable travelling bag as tokens of their regard for him. The presentation was made at the Company's headquarters in Rensselaer, and the bestower was Mr. Randall J. Le Boeuf. Of course, Mr. Darbee responded in appropriate manner. He goes to Baltimore, there to act as Assistant General Manager of the Consolidated Gas, Electric Light and Power Company. His successor in the Rensselaer division is Mr. Raymond H. Smith.

MR. AND MRS. EDWARD EARNSHAW have removed to Newark, N. J., from Cincinnati, O. We understand that Mr. Earnshaw is to resume his connection with the staff of the United Gas Improvement Company.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance.
Single copies, 10 cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, SEPTEMBER 2, 1907.

The Market for Gas Securities.

Back again to the par regions for Consolidated at one time this week, and the opening to-day was only a trifle better—102⅛ bid. Why advise anything about possible courses of the market, with almost everyone in authority, from Oyster Bay, L. I., to Sonoma Point Light, Cal., clubbing up or screeching at the owners of vested interests.

Brooklyn Union is quoted at 90 bid, and Peoples, of Chicago, is at the extremely ridiculous figure of 86 to 87. Strange to say, within the last 10 days quite a demand has arisen for city gas bonds. It is certainly not wide of the mark to say they are well worth hunting up, "at the market!"

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 2.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y City Companies	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	102⅛	104
Central Union Gas Co.—				
1st 5's, due 1942, J & J	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	150	180
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	80	90
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	48
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	..	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	90	100
1st Con. 5's, due 1948, M. & N	15,000,000		..	102
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅝
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	95¼	96⅛
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co.	1,662,750	100	87	88
Preferred	3,096,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	90
Mortgage, 6's	3,000,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co.	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	3,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,235,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	100	105
Bonds, 5's	10,500,000	..	101	103½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104½
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies of Boston	25,000,000	100	50	50½
Preferred	25,000,000	100	79	80
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	86	87
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	00	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	375	380
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	230	..

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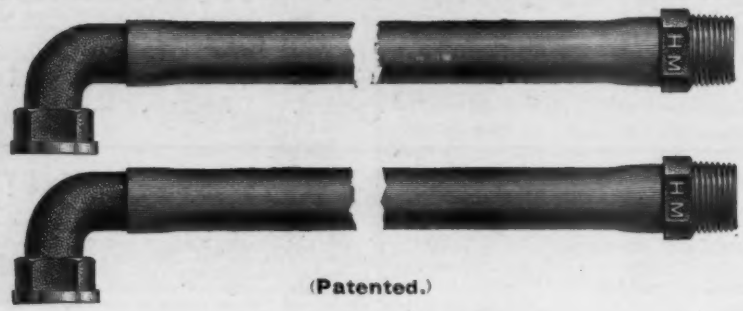

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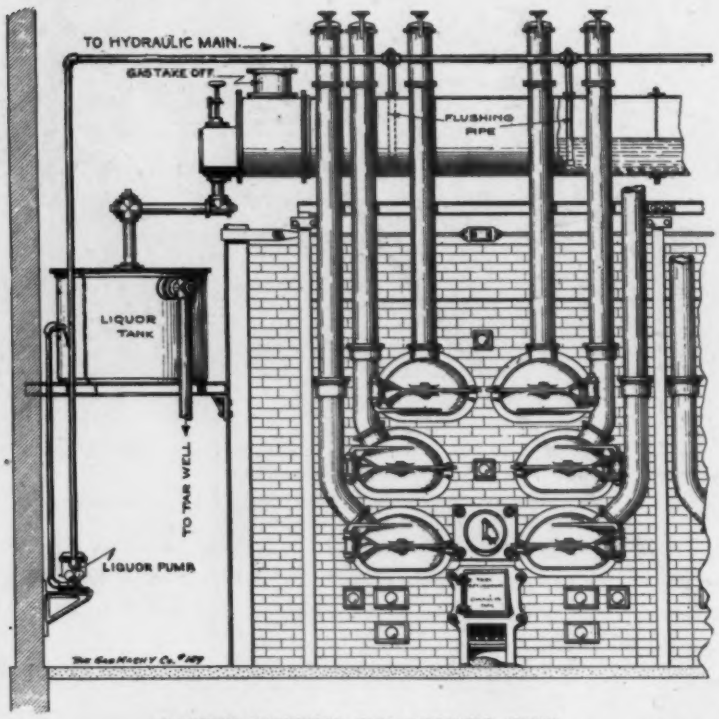

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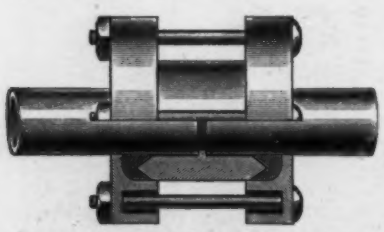
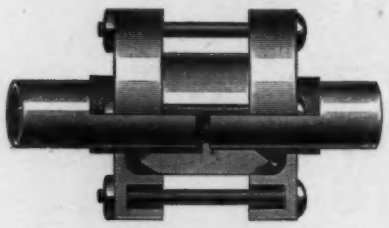

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.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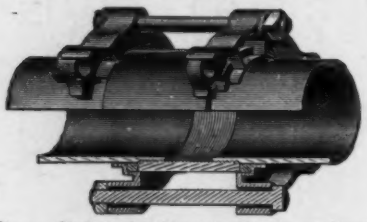
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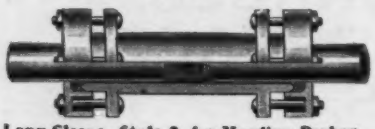
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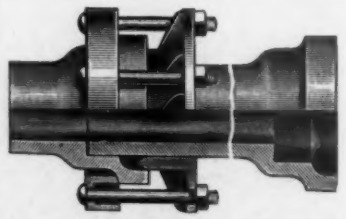
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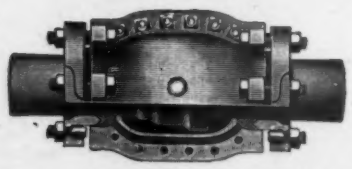
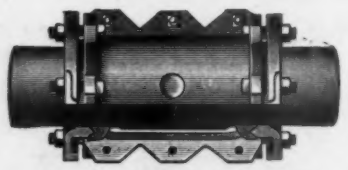
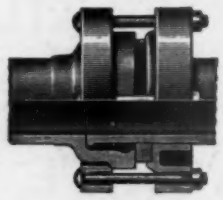

Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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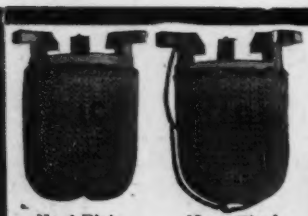
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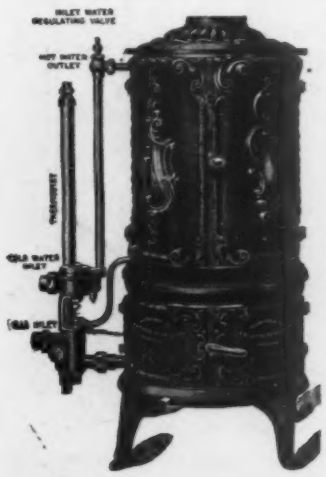

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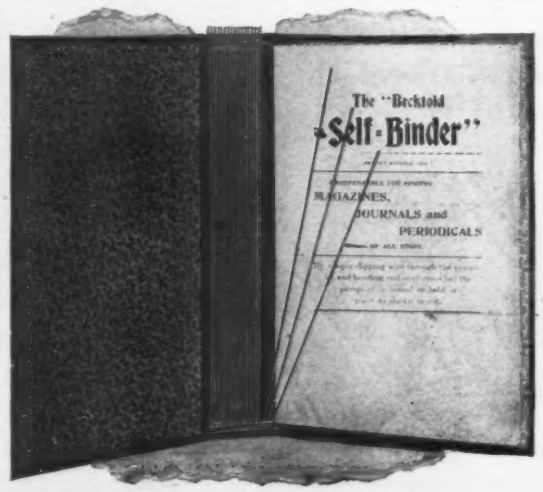

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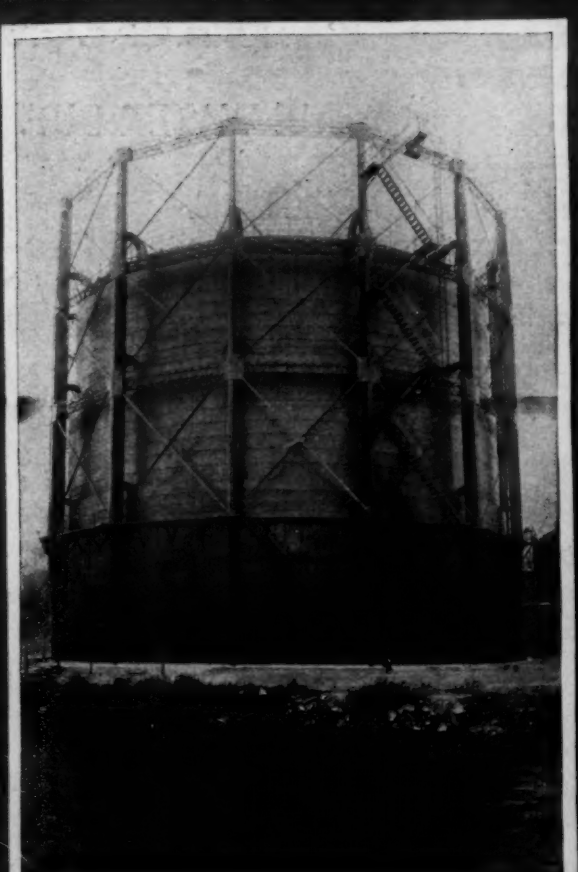

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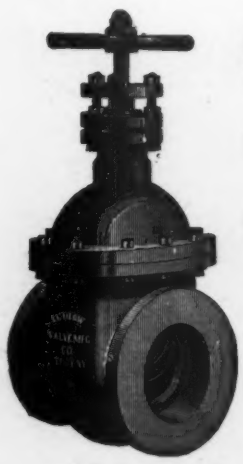

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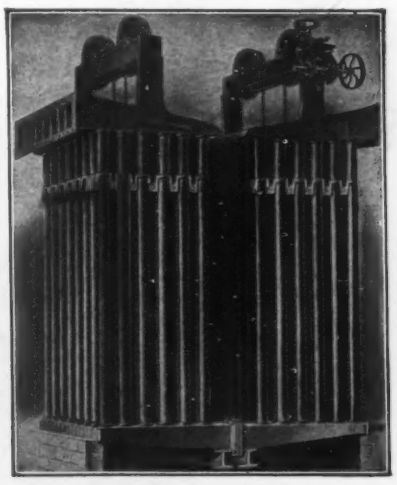

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For Handling Coal and Coke in Gas Works.

The cost of handling coal and coke by this method is only the expense of loading the cars (one man) and the power to drive the cable. Every inch of ground is available, as the space under the trestles can be utilized for storage, if necessary. These railways are built of different types, to handle any quantity of material, large or small.

If you are interested in the subject, we will take pleasure in sending you photographs of some of the plants we have installed upon receipt of your card, and will give such information as is in our power if you will let us know your requirements.

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For every 1,000 cu. ft. of water gas 40 to 48 lbs. of anthracite are consumed in the generator, while 24 lbs. should theoretically be enough. The 40 per cent. to 50 per cent. excess is the margin of possible saving. By passing the hot, waste, stack-valve gases through a GREEN AIR HEATER you can cut down the bill for generator coal by at least 10 per cent. The air forced to the generator is passed through the tubes of the Air Heater and absorbs the waste heat from the stack-valve gases and returns it to the generator. The higher temperature in the generator, carburetter and superheater results, also, in a saving of oil, amounting to about one-fifth gallon per 1,000 cu. ft. of gas.

After the stack-valve gases have passed through the Green Air Heater they may be then passed through a GREEN FUEL ECONOMIZER to heat the boiler feed water, saving as much as 25 per cent. of the boiler fuel. The result is that a Green Air Heater and a Green Fuel Economizer will save from 50 per cent. to 60 per cent. of their first cost annually in a water gas plant. Write for circular "AG" and results of actual tests.

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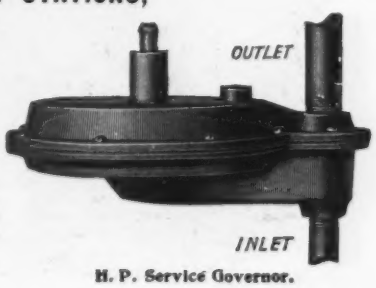

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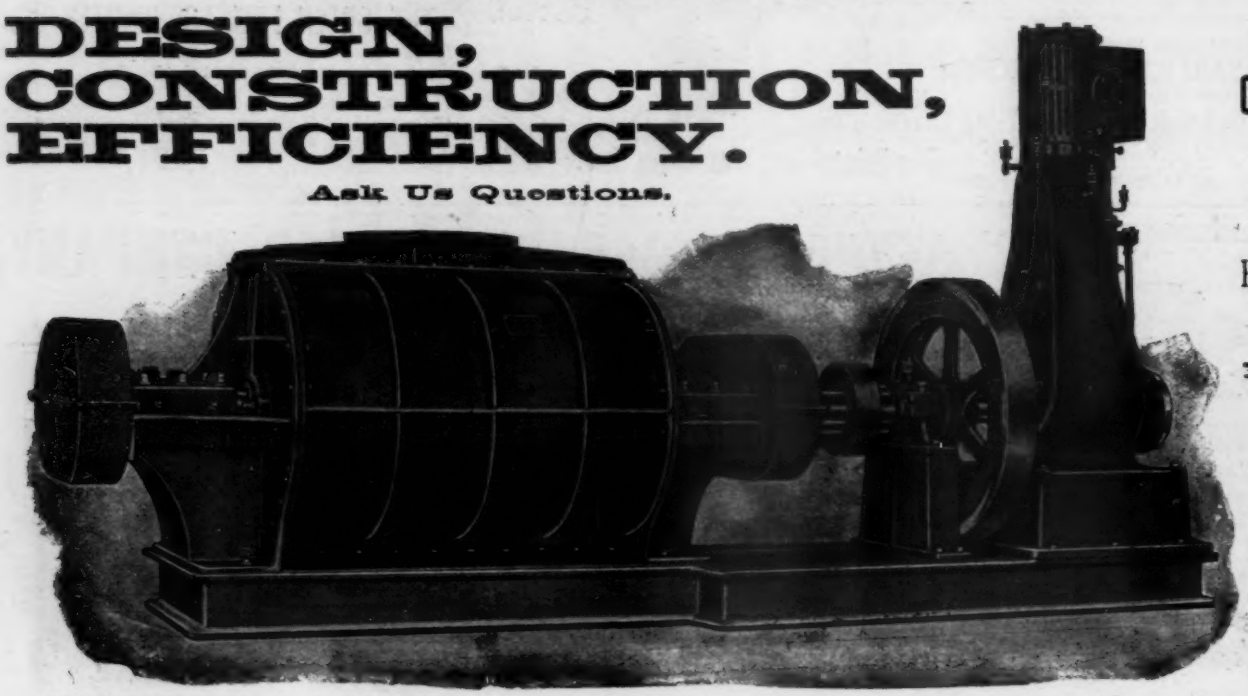

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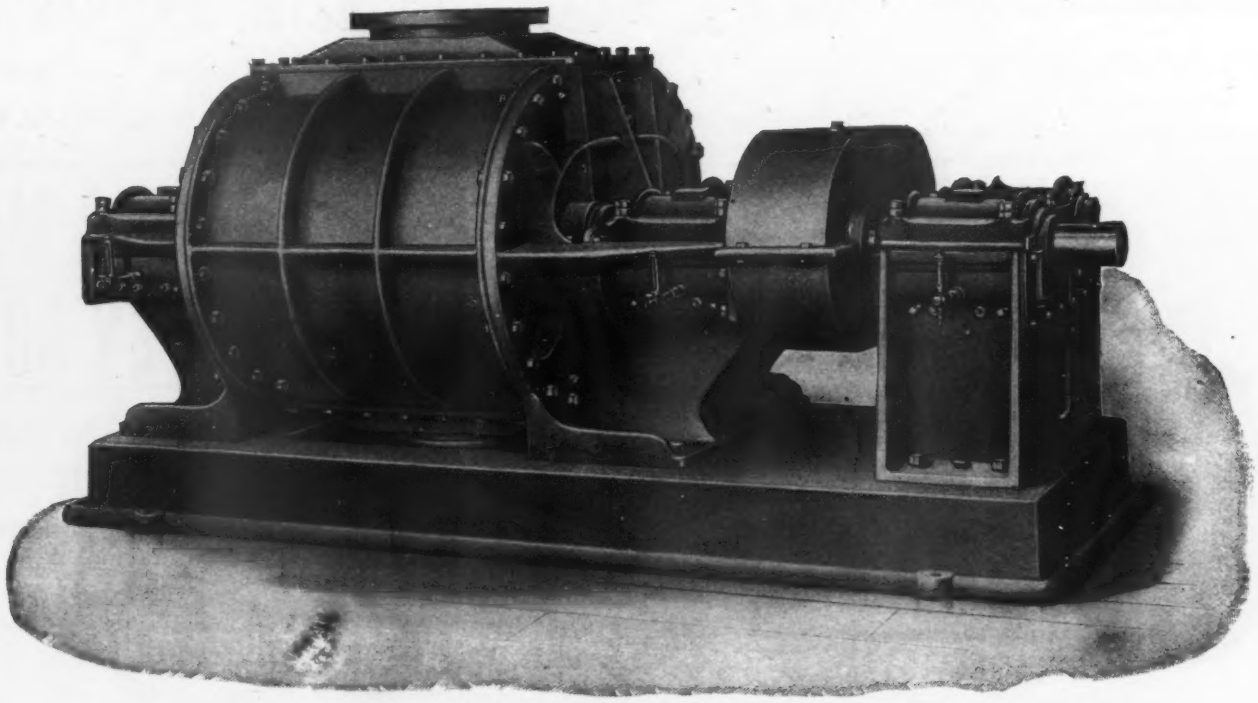

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Machines Sent to any Gas Company for Thirty Days' Trial.

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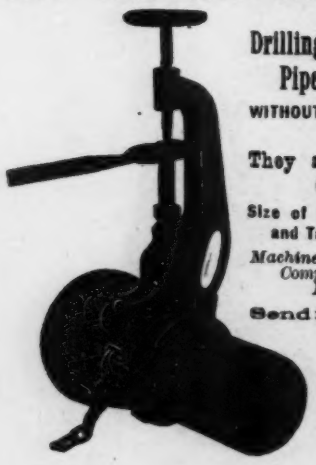

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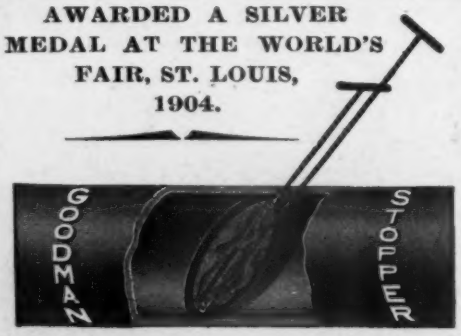

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Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

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With Instructions for Care and Working of the Same,
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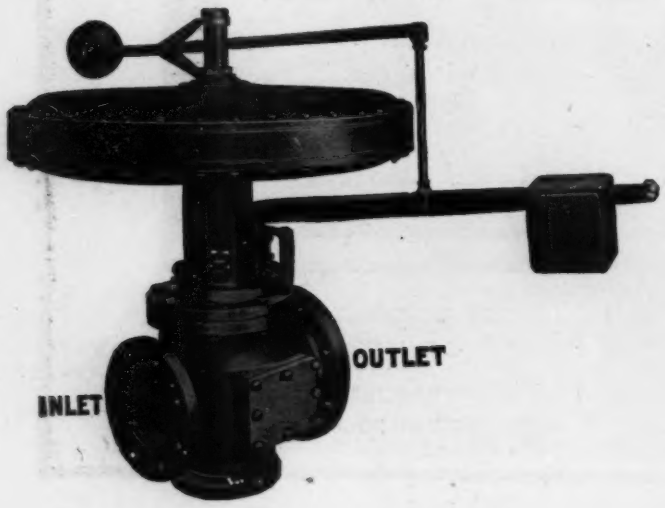

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WITH AUTOMATIC SAFETY CUTOFF.

For Artificial or Natural Gas.
For District or Service Use.

Our DUPLEX SENSITIVE GOVERNOR, with Automatic Cutoff for district service, will reduce high pressure gas to inches of water without variation.

Absolutely safe and reliable. No complicated mechanism to get out of order. More than 20 years' experience with the largest gas companies.

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AMERICAN METER CO.,

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

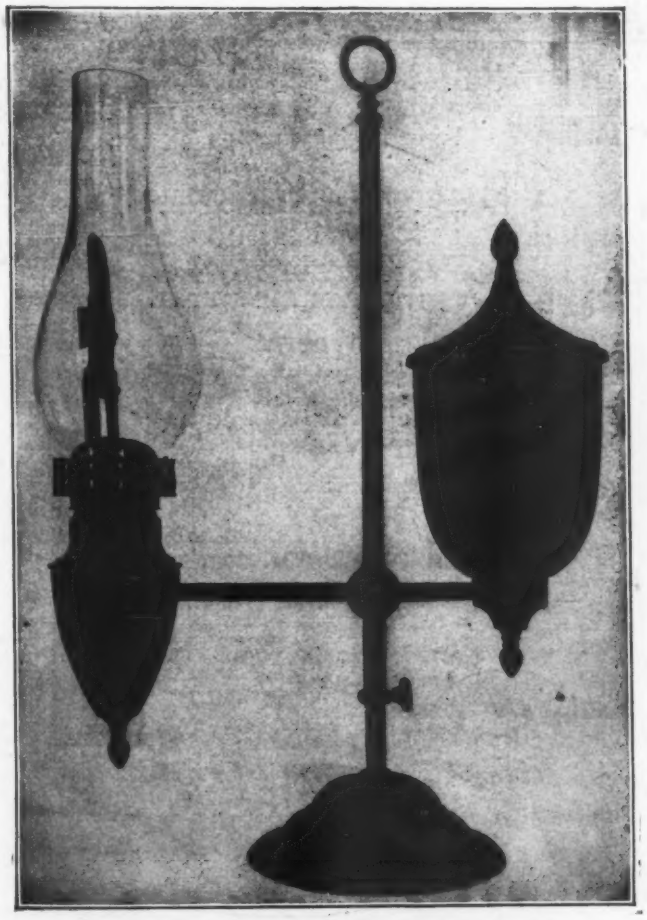
SEPTEMBER, 1907.

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Sun.	1	7.00 PM	1.20 AM
Mon.	2	7.0	2.10
Tue.	3	7.00	3.10
Wed.	4	7.00	4.30
Thu.	5	7.00	4.30
Fri	6	7.00	4.30
Sat.	7	7.00 NM	4.30
Sun	8	6.50	4.40
Mon	9	6.50	4.40
Tue.	10	6.50	4.40
Wed.	11	6.50	4.40
Thu.	12	8.10	4.40
Fri.	13	8.50	4.40
Sat.	14	9.40 FQ	4.40
Sun.	15	10.30	4.40
Mon.	16	11.30	4.40
Tue.	17	12.30 AM	4.40
Wed.	18	1.50	4.40
Thu.	19	3.00	4.40
Fri.	20	No L.	No L.
Sat.	21	No L FM	No L.
Sun.	22	No L.	No L.
Mon.	23	6.20 PM	8.20 PM
Tue.	24	6.20	8.50
Wed.	25	6.20	9.20
Thu.	26	6.20	10.00
Fri.	27	6.20	10.40
Sat.	28	6.20 LQ	11.20
Sun.	29	6.10	12.00
Mon.	30	6.10	1.00 AM

TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20



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❋❋❋

10-Candle Power.

❋❋❋

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1907.

Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Light.	Extinguish.
		P. M.	A. M.
Sun.	1	6.30	4.20
Mon.	2	6.30	4.20
Tue.	3	6.15	4.30
Wed.	4	6.15	4.30
Thu.	5	6.15	4.30
Fri.	6	6.15	4.30
Sat.	7	6.15	4.30
Sun.	8	6.15	4.30
Mon.	9	6.15	4.30
Tue.	10	6.05	4.40
Wed.	11	6.05	4.40
Thu.	12	6.05	4.40
Fri.	13	6.05	4.40
Sat.	14	6.05	4.40
Sun.	15	6.05	4.40
Mon.	16	6.05	4.40
Tue.	17	5.55	4.50
Wed.	18	5.55	4.50
Thu.	19	5.55	4.50
Fri.	20	5.55	4.50
Sat.	21	5.55	4.50
Sun.	22	5.55	4.50
Mon.	23	5.55	4.50
Tue.	24	5.40	5.00
Wed.	25	5.40	5.00
Thu.	26	5.40	5.00
Fri.	27	5.40	5.00
Sat.	28	5.40	5.00
Sun.	29	5.40	5.00
Mon.	30	5.40	5.00

TOTAL HOURS DURING 1907.

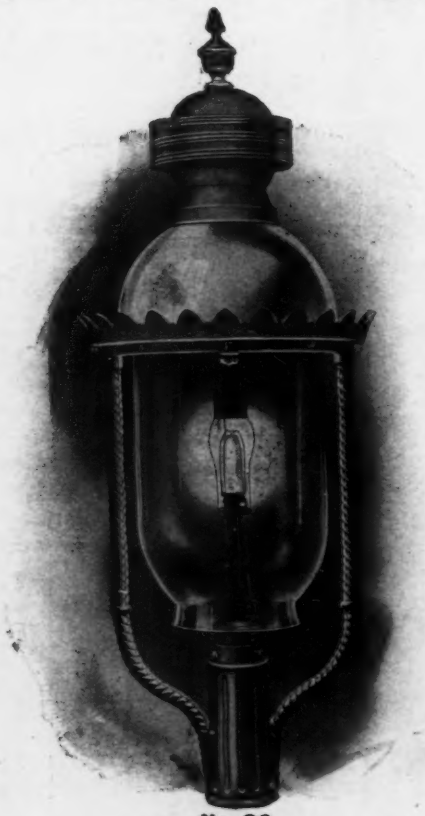
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.40

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building.
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



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Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

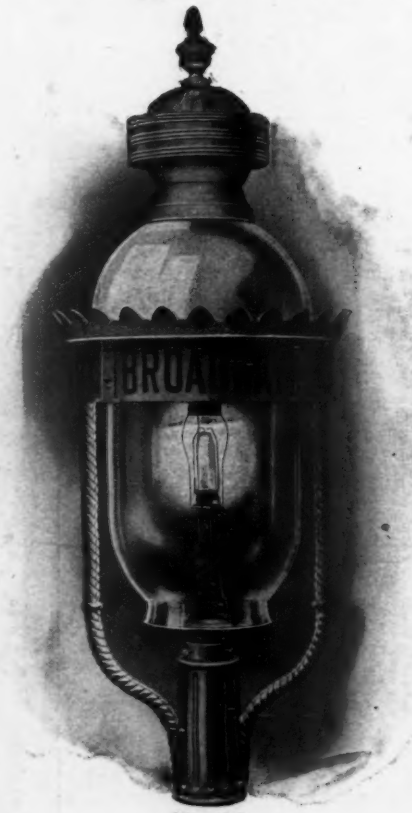
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



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THE BURNER.

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Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
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THE MANTLE.

Best Welsbach Quality.
Extra Strong and Durable.
Highest Maintained Candle Power.
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THE GLASSWARE.

Highest Quality Imported.
Special Design Inner Cylinder (No. 317).
Protection from the Falling of Heated Particles.
Increases Candle Power.

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Coney Island, N. Y.
Mexico, Mo.
Jacksonville, Fla.
Syracuse, N. Y. (2d contract).
Atlanta, Ga. (3d contract).
Holyoke, Mass.
Peoria, Ills.
Schnectady, N. Y. (2d contract).
Danbury, Conn.
Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
Sioux Falls, S. D. (3d contract).
Philadelphia, Pa.

TOTAL SETS INSTALLED TO JULY 1, 1907, ... 34
TOTAL SETS TO DATE, ... 668
TOTAL DAILY CAPACITY, ... 541,655,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.

Established 1858. Incorporated 1890.
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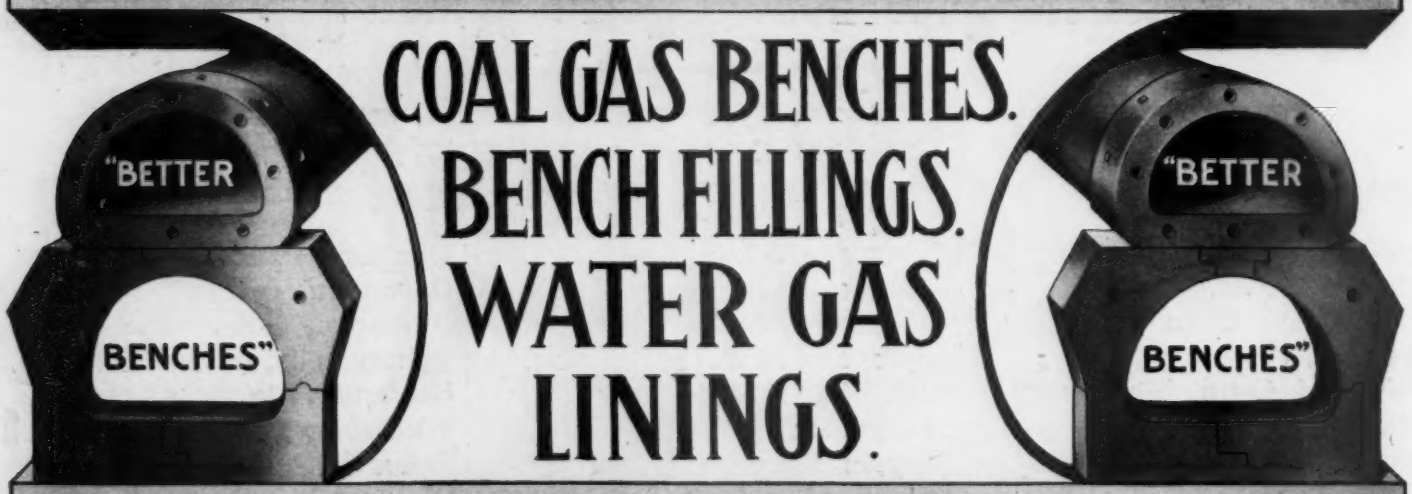

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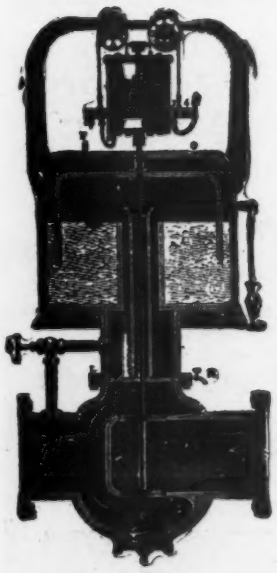

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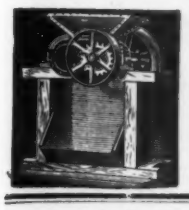

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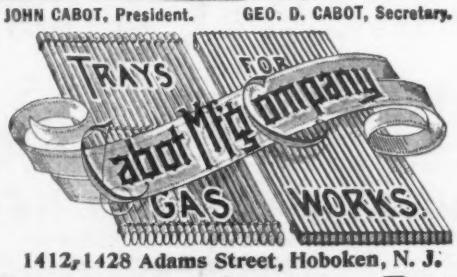

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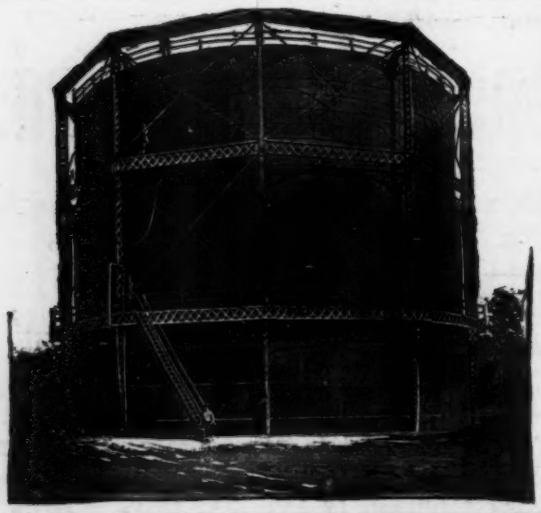

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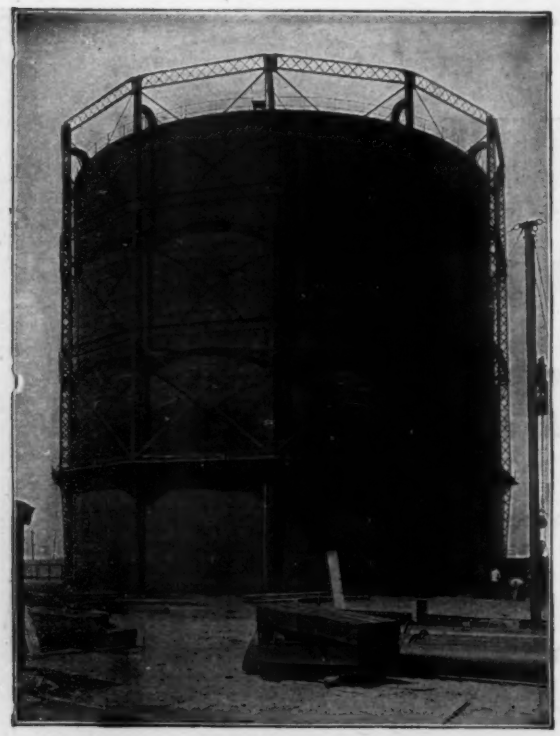

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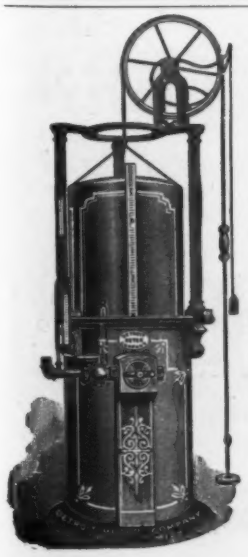

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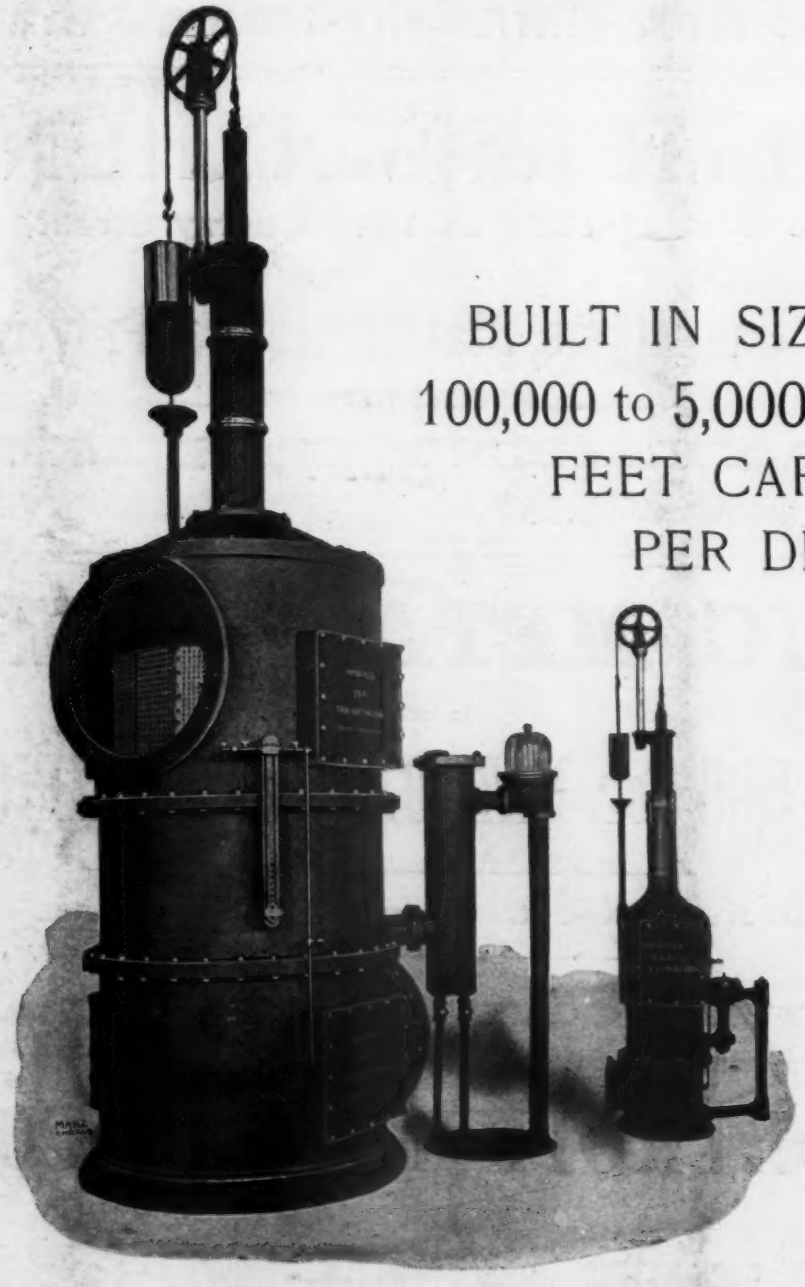

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